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# FOOD TECHNOLOGY ABSTRACTS



Central Food Technological Research Institute, Mysore  
National Information System for Science and Technology  
Department of Scientific and Industrial Research, New Delhi



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# **FOOD TECHNOLOGY ABSTRACTS**

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National Information Centre For Food Science And Technology  
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## ABBREVIATIONS

A	ampere
AAS	atomic absorption spectrometry
ADP	adenosine diphosphate
Anon.	Anonymous
AOAC	Association of Official Analytical Chemists
approx.	approximately
atm	atmosphere
ATP	adenosine triphosphate
$a_w$	water activity
BHA	butylated hydroxyanisole
BHT	butylated hydroxytoluene
b.p.	boiling point
Btu	British thermal unit
c-	centi- [as in cm, cm <sup>2</sup> , cm <sup>3</sup> ]
cal	calorie
cd	candela
°C	degree centigrade
Cl	curie
CMC	carboxymethyl cellulose
coeff.	coefficient
conc.	concentrated
concn.	concentration
cv.	cultivar
cwt	hundredweight
d-	deci-
DE	dextrose equivalent
detn.	determination
DFD	dark firm dry
diam.	diameter
dil.	dilute
DM	dry matter
DNA	deoxyribonucleic acid(s)
dyn	dyne
E.	East, Eastern, etc
ECD.	electron capture detection
EDTA	ethylenediaminetetraacetic acid
Eh	oxidation-reduction potential
ELISA	enzyme-linked immunosorbent assay
f-	femto- [10 <sup>-15</sup> , as in fCi]
°F	degree Fahrenheit
FAO	Food and Agricultural Organization
FDA	Food and Drug Administration
FID	flame ionization detection
fl oz	fluid ounce
f.p.	freezing point
ft	foot, feet
g	gram
GC	gas chromatography

gr	gravity
gal	gallon
gf	gram-force
GLC	gas-liquid chromatography
h	hour
ha	hectare
HDPE	high density polyethylene
hl	hectolitre [100 l]
hp	horse power
HPLC	high performance/pressure liquid chromatography
HTST	high temperature short time
Hz	hertz [frequency cycles/s]
in	inch
IR	infrared
IU	international unit
J	joule
k-	kilo- [as in kcal, kg]
K	Kelvin
l	litre
lb	pound
lbf	pound-force
LDPE	low density polyethylene
m-	milli- [as in mg, ml, mm]
m-	equivalent
M	molar concentration
M-	mega- [as in Mrad]
max.	maximum
min	minute [time]
min.	minimum
mol	mole
mol.wt.	molecular weight
m.p.	melting point
MPN	most probable number
MS	mass-spectrometry
n-	nano- [10 <sup>-9</sup> , as in nm]
N	Newton [kg m/s <sup>2</sup> ]
N.	North, Northern, etc
N	Normal concentration
NMR	nuclear magnetic resonance
NPU	net protein utilization
oz	ounce
p-	pico- [10 <sup>-12</sup> , as in pCi]
P	Poise
p	probability
Pa	pascal (N/M <sup>2</sup> )
PAGE	polyacrylamide gel electrophoresis
PER	protein efficiency ratio
p.p.b.	parts per billion
p.p.m.	parts per million
PSE	pale soft exudative
PTFE	polytetrafluorethylene
PVC	polyvinyl chloride
PVDC	polyvinylidene chloride

qt	quart
R	rontgen
rad	rad or radian
ref.	reference(s)
rev/min	revolutions per minute
RH	relative humidity
RNA	ribonucleic acid(s)
S.	South, Southern, etc.
s.d.	standard deviation
SDS	sodium dodecylsulphate
s.e.	standard error
s	second [time]
SNF	solids-not-fat
sp., spp.	species
sp.gr.	specific gravity
summ.	summary
Suppl.	Supplement
t	metric tonne
temp.	temperature
TLC	thin layer chromatography
TS	total solids
UHT	ultra-high temperature
UV	ultraviolet
V	volt
var.	variety
vol.	volume
v/v	volume/volume
W	watt
W.	West, Western, etc.
WHO	World Health Organization
w/v	weight/volume
wk	week
wt.	weight
yd	yard
yr	year
μ	micro- [as in g, μm]
%	per centum
>	greater than
≥	greater than or equal to; not less than
<	less than
≤	less than or equal to; not greater than

## ABBREVIATIONS FOR LANGUAGES

Language of text	
Dutch	Nl
French	Fr
German	De
Italian	It
Japanese	Ja
Norwegian	No
Spanish	E
Swedish	Sv



207

Kalra (CL), Sehgal (RC), Nagender (A) and Berry (SK). **Preparation, packaging and quality standards of Mongra: A traditional savoury product.** *Journal of Food Science and Technology (India)* 35(5); 1998; 414-418

Thirty two samples of *mongra* were analyzed for their chemical composition. *Mongra* varied widely in its chemical composition. The ranges of variations in respect of moisture (0.18-6.9%), proteins (15.16-21.15%), ether extractives (37.13-61.33%), common salt (0.98-3.90%) and total ash (1.71-5.11%) have been reported. A standard recipe was developed to prepare laboratory samples. Based on these values, frequency distribution histograms have been plotted and quality standards for *Mongra* have been suggested. *Mongra* prepared in refined cottonseed oil by incorporation of antioxidant (BHA at 0.1 g/kg flour) had a better shelf life. To ascertain the packaging requirements of *Mongra*, ERH studies have been conducted. The ERH of *Mongra* bearing initial moisture 2.63% was found to be 53.4%. AA

## FOOD PACKAGING

208

Newton (W) and Vink (W). **Why do we package?.** *Manufacturing Confectioner* 78(9); 1998; 171-176

Discusses the role of modern day packaging which involves product protection, unit sales, point-of-purchase advertising, brand awareness and potential as an additional consumer product. CSA

## FOOD ENGINEERING AND EQUIPMENT

209

Denys (S), Loey (AMV), Hendrickx (ME) and Tobback (PP). **Modeling heat transfer during high-pressure freezing and thawing.** *Biotechnology Progress* 13(4); 1997; 416-423

An existing theoretical model for predicting product temp. profiles during freezing and thawing

processes was extended for simulating high-pressure freezing and thawing processes. To take into account the influence of elevated pressure a simplifying approach is suggested, consisting of shifting the known thermophysical properties at atmospheric pressure on the temp. scale depending on the prevalent pressure. The applicability of the method to simulate high-pressure freezing and thawing profiles was tested for a food simulant (Tylose). Good agreement between experimental and predicted temp. profiles was observed for both high pressure freezing and thawing. AA

210

Igathinathane (C) and Chattopadhyay (PK). **On the development of a ready reckoner table for evaluating surface area of general ellipsoids based on numerical techniques.** *Journal of Food Engineering* 36(2); 1998; 233-247

Surface areas of food materials resembling general ellipsoids can be obtained from the principal dimensions by numerical techniques. Nodes were identified on the surface along the principal planes in the developed model for generating a series of flat triangular element grids and their assembly gave the surface area of the ellipsoidal material. The model was validated against simpler geometries, such as sphere, prolate spheroids and oblate spheroids, and was found to be accurate. With the combination of non-dimensional input in the models and scaling factor a two-dimensional ready reckoner table of reduced surface areas was developed, which covered the entire range of sizes and shapes of general ellipsoid. The method of obtaining the intermediate values in the table by univariate and bivariate linear interpolation was also outlined and the interpolation error was in the range of 0.0-0.57%. The nomogram representation of the table can be utilised for rough estimates. The actual surface area of the object is obtained from the reduced surface area by multiplying it by the scaling factor. AA

211

Mirade (PS) and Daudin (JD). **A new experimental method for measuring and visualising air flow in large food plants.** *Journal of Food Engineering* 36(1); 1998; 31-49

A new experimental method was developed to visualise air flow patterns and spatial distribution of the mean air velocity in large food plants. The continuous motion of an anemometer measuring air



velocity at regular intervals made it possible to rapidly obtain measurements at several thousands of points. The processing of these measurements by Fourier's series and a low-pass filter eliminated the time-fluctuations due to air flow unsteadiness and only the spatial variations of the mean air velocity were kept afterwards. This paper shows how this method was applied in the food industry to a typical meat chiller. The graphical representation of the mean air velocity distribution brought to light dysfunction inside the chiller. The experimental tool presented here can help specialists to carry out diagnoses of the air flow in food plants. AA

212

Teixeira (MBF) and Tobinaga (S). **A diffusion model for describing water transport in round squid mantle during drying with a moisture-dependent effective diffusivity.** *Journal of Food Engineering* 36(2); 1998; 169-181

To date, only experimental drying studies have been published for the drying squid mantle, neglecting the transport phenomenon of water in squid muscle. Added to this, the published studies of mass transfer phenomena during the drying of fish and other seafoods are always based on Fick's second law for evaluating constant effective diffusivity. Therefore, the dependence of the latter transport property on the moisture of muscle is unknown. This work studies the mass transfer of water during the drying of squid mantle (*Loligo brasiliensis*), previously salted and smoked by liquid smoking (hickory extract), where the effective diffusivity was taken as an exponential function of moisture. The results thus obtained were compared with values calculated from the slope method. The model, based on the Fick's second law and solved by the finite difference explicit method, was applied to a hollow cylinder geometry (round squid mantle) without considering the shrinkage. AA

213

Campanella (OH) and Peleg (M). **On the  $\tan\delta$ -frequency relationship of foods and agricultural commodities.** *Journal of Texture Studies* 28(5); 1997; 585-592

Published discrete relaxation times spectra of agar and alginate gels, alfalfa, apple and potato flesh, meat cheese and wheat dough were used to calculate the frequency or frequencies where the phase angle  $\delta$  ( $\omega$  vs. frequency,  $\omega$ , relationship

peaks). This was done by solving, numerically, the equation  $d\tan\delta(\omega)/d\omega = 0$  where  $d^2\tan\delta(\omega)/d\omega^2 < 0$ , with  $\tan\delta(\omega)$  being an algebraic expression derived from the discrete Maxwell model of stress relaxation. The  $\omega_{peak}$  of the materials examined was in the range of  $10^{-3}$  to  $10^{-1}$  Hz band, setting a lower limit to the frequencies at which such materials can be compared by dynamic tests. This also indicates that the plot of  $\tan\delta(\omega)$  vs.  $\omega$  in linear or logarithmic coordinates must have a negative slope at any frequency range above about 0.5 Hz. The frequency at which the peak appears,  $\omega_{peak}$ , is primarily determined by the relative wt. of the elastic component and the elements of long relaxation times. The higher it is the lower  $\omega_{peak}$  is. Thus, the latter can serve as a measure of solidity, inherent to the material or caused by external conditions or through a textural modification. AA

214

Torres (AP) and Oliveira (FAR). **Residence time distribution studies in continuous thermal processing of liquid foods: A review.** *Journal of Food Engineering* 36(1); 1998; 1-30

A review on residence time distribution (RTD) studies in continuous thermal processing of liquid foods. The theoretical basis of the Danckwerts analysis is summarized, as well as the most important flow models, with special emphasis on tubular systems. Methods for experimental detn., modelling and estimation of RTD are critically described. While main design objectives in continuous thermal processes may be guaranteed by a proper min. residence or holding time, process optimization requires the knowledge of the RTD. Both concepts are reviewed and discussed. A significant scatter was noticed among published results and the need for a systematic work is clear. It was concluded that future research should focus on studies at pasteurization/sterilization temp., as well as on studies conducted with real food products or model food systems with non-Newtonian flow behaviour. Furthermore, information relating RTD to processing conditions would be a useful tool for process optimization. AA

215

Lewicki (PP). **Some remarks on rehydration of dried foods.** *Journal of Food Engineering* 36(1); 1998; 81-87



The paper discusses inconsistencies in measuring procedures and calculations of rehydration indices for dried foods. A new method to calculate rehydration ability is proposed, which is based on the capacity of dried material to absorb water and to hold solubles inside the matrix. Rehydration indices of dried potato, apple and root of parsley are expressed by methods described in the literature and the new method. Simplistic and straightforward interpretation of the new indices is shown. Analysis of variance shows which variables must be precisely measured in order to keep the variance of the new indices as small as possible. AA

## ENERGY IN FOOD PROCESSING

Nil

## FOOD CHEMISTRY AND ANALYSIS

### Chemistry

216

Mustapha (WAW), Hill (SE), Blanshard (JMV) and Derbyshire (W). **Maillard reactions: Do the properties of liquid matrices matter?** *Food Chemistry* 62(4); 1998; 441-449

The amounts of browning due to the interaction of lysine and xylose occurring when these reactants were in different liquids have been investigated. The reactants were suspended/solvated in water, corn oil, glycerol, different propylene glycols and mixtures of these liquids. In water the amount of browning was found to equate to the concn. of the reactants to the third power. In glycerol and polypropylene glycol 76<sup>o</sup> the amount of browning was higher than that achieved for the same amount of reactants in water. In corn oil and polypropylene glycol 1200 no browning was observed. In all samples the addition of water to another liquid caused the level of browning to be increased, until a max. was achieved. This max. may have corresponded to the point where all the reactants were soluble in the matrix. Further addition of water decreased the amount of browning. In all cases the amount of browning seemed to relate to the concn. of the reactants if they were calculated as just occurring in the water portion of the matrix. Values calculated in this way were significantly, but constantly a little lower than the

experimental results in all cases except for the corn oil, where the values directly corresponded. The predictability of these values was surprising considering that the matrices gave miscible and phase-separated systems. AA

217

Ames (JM). **Applications of the Maillard reaction in the food industry.** *Food Chemistry* 62(4); 1998; 431-439

This paper summarise some recent work concerned with the development of colour and flavour via the Maillard reaction in both aqueous and restricted moisture model systems. HPLC and capillary electrophoresis (CE), both with diode array detection, are discussed for their ability to separate reaction products. The use of the diode array data to classify reaction products is presented. The coloured reaction products identified from aqueous sugar-amino acid systems are summarised, and their contribution to the colour of total model systems is considered. The effects of temp./time, pH and high pressure on the development of colour and flavour in Maillard model systems are presented. Colour measurement data and quantitative descriptive analysis (QDA) data are given for a starch-glucose-lysine model system extruded at different feed pH values. The use of a laboratory reaction cell to mimic most of the conditions encountered in the extruder is discussed. Its use to obtain information for the successful prediction of colour development in the extruder is presented. AA

218

From (M), Adlercreutz (P) and Mattiasson (B). **Lipase catalyzed esterification of lactic acid.** *Biotechnology Letters* 19(4); 1997; 315-317

Reactions between lactic acid and alcohols or carboxylic acids catalyzed by lipase from *Candida antarctica* were evaluated with hexane as solvent. Lactic acid was a good acyl donor and esters of both primary and secondary alcohols were effectively synthesized. No interfering dimer formation due to lactic acid acting as both nucleophile and acyl donor was observed. In agreement with this, no esterification occurred between lactic acid and carboxylic acids. AA

219

Royle (L), Bailey (RG) and Ames (JM). **Separation of Maillard reaction products from**



**xylose-glycine and glucose-glycine model systems by capillary electrophoresis and comparsion to reverse phase HPLC.** *Food Chemistry* 62(4); 1998; 425-430

Capillary electrophoresis (CE) and reverse phase (RP) HPLC were used to analyse Maillard reaction products (MRPs) formed in refluxed, aqueous xylose-glycine and glucose-glycine model systems. CE was shown to resolve many more components than RP-HPLC. Ultrafiltration was used to separate the MRPs into three mol. wt. fractions, nominally > 3000, between 3000 and 1000, and < 1000 daltons. Components of the lowest mol. wt. fraction migrated as sharp, well-resolved peaks by CE, whereas the components of the higher mol. wt. fractions (melanoidin) migrated as a single broad peak in each case. The melanoidin and the majority of the low mol. wt. compounds migrate as anions in borate buffer at pH 9.3, some of this anionic character being due to complexation with borate. The majority of colour in the systems was attributed to the melanoidin, with only two other CE peaks in the xylose-glycine, and one in the glucose-glycine systems having significant absorbancies in the visible region. AA

220

Weenen (H). **Reactive intermediates and carbohydrate fragmentation in Maillard chemistry.** *Food Chemistry* 62(4); 1998; 393-401

Much research is devoted to the elucidation of mechanisms in the Maillard reaction. Model studies with reactive intermediates and <sup>13</sup>C-labelled precursors have contributed significantly to our understanding of flavour formation in the Maillard reaction. Several examples are discussed here: The formation of methyl pyrazines and 2-acetyl-1-pyrroline, the role of ARP's and deoxyglycosones and the formation of carbohydrate fragments from reducing sugars, 3-deoxy-glucosone and ARP's. It is concluded that carbohydrate fragments, and also flavour substances derived thereof, are formed from the starting reducing sugars (or the corresponding imines), deoxyglycosones, and possibly ARP's. A general scheme for flavour formation in the Maillard reaction is proposed. AA

221

Chauhan (AS), Ramteke (RS) and Eipeson (WE). **Properties of ascorbic acid and its applications in food processing: A critical appraisal.** *Journal*

*of Food Science and Technology (India)* 35(5); 1998; 381-392

L-ascorbic acid (vitamin C) plays important roles in human nutrition as well as in food processing. L-ascorbic acid occurs naturally in fruits and vegetables and citrus fruits are rich sources of this vitamin. The west Indian cherry is reported to be the richest source of L-ascorbic acid. It exists in a var. of tautomeric forms. Its chemical properties show reducing behaviour and it can form derivatives. Titrimetric and spectrophotometric methods can be used for the analytical detn. of L-ascorbic acid. Commercially, L-ascorbic acid is manufactured either by enzymatic method or by a direct fermentation process. Ascorbic acid finds several applications in food processing. It acts as a preservative to prevent enzymatic browning during processing, as an antioxidant and it promotes clarity as well as preservation of taste and flavour during beer and wine fermentation as well as many other food processing operations. This paper critically reviews the various aspects of L-ascorbic acid such as its occurrence, chemistry, analytical methods for its detn., commercial synthesis and its role in food processing *vis-a-vis* human nutrition. AA

#### Chemistry (Analytical)

222

Suarez (AM), Azcona (JI), Rodriguez (JM), Sanz (B) and Hernandez (PE). **One-step purification of nisin A by immunoaffinity chromatography.** *Applied and Environmental Microbiology* Vol 63(12); 1997; 4990-4992

The lantibiotic nisin A was purified to homogeneity by a single-step immunoaffinity chromatography method. An immunoabsorption matrix was developed by direct binding of anti-nisin A monoclonal antibodies to N-hydroxysuccinimide-activated sepharose. The purification procedure was rapid and reproducible and rendered much higher final yields of nisin than any other described method. AA

223

Sostmann (K) and Guichard (E). **Immobilized  $\beta$ -lactoglobulin on a HPLC-column: A rapid way to determine protein-flavour interactions.** *Food Chemistry* 62(4); 1998; 509-513



To study the interaction of  $\beta$ -lactoglobulin (BLG) with flavour compounds a fast screening methodology was developed. BLG (variant AB, pure A and pure B) was immobilized onto a silica support, filled into a column and combined with a HPLC-system. A total of 24 different flavour compounds were injected and their retention times determined at different pHs and protein concn. The binding constant for each compound was calculated from the retention times and the protein concn. of the column. This simple system allows the rapid screening of many flavour compounds under a var. of external conditions like pH, salt content and flavour concn. This procedure also permits the study of competitive effects with several flavour compounds in the sol. AA

## FOOD MICROBIOLOGY AND HYGIENE

### Microorganisms

224

Djordjevic (GM) and Klaenhammer (TR). **Bacteriophage-triggered defense systems: Phage adaptation and design improvements.** *Applied and Environmental Microbiology* 63(11); 1997; 4370-4376

A novel bacteriophage defense system, based on an inducible suicide gene, was challenged with a lactococcal bacteriophage to investigate the potential for phage adaptation. The defense system was encoded by pTRK414H, a high-copy-number replicon encoding a tightly regulated  $\phi 31$ p trigger promoter fused to the lethal *LlaIR*<sup>+</sup> restriction endonuclease cassette. Repeated transfers of *Lactococcus lactis* NCK690(pTRK414H) in the presence of  $\phi 31$  selected for phage  $\phi 31$  derivatives which were markedly less sensitive to  $\phi 31$ p-*LlaIR*<sup>+</sup>-encoded restriction than the parental phage,  $\phi 31$ . The efficiency of plaquing (EOP) on *L. lactis* NCK690(pTRK414H) was  $10^{-4}$  for  $\phi 31$  versus 0.4 for the derived phages. The mutant phages remained fully sensitive to *LlaIR*<sup>+</sup> restriction, suggesting an alteration in the recognition or firing of the  $\phi 31$ p promoter. Sequencing over the promoter region in four mutant phages revealed the identical C-to-A transversion, generating a Phe-to-Leu substitution, in a transcriptional activator of the  $\phi 31$ p promoter, designated ORF2. The mutant phages were analyzed for their ability to induce the native  $\phi 31$ p promoter element fused to a *lacZ.st* reporter gene. Compared to the parental phage,  $\phi 31$ , lower

levels of  $\beta$ -galactosidase activity were induced throughout the lytic cycle, indicating that the strength at which the mutant phages activated the  $\phi 31$ p promoter was altered. Based on these observations, improvements were made in promoter strength and restriction activity in an attempt to elevate the effectiveness of the phage-triggered suicide system. When the  $\phi 31$ p-*LlaIR* cassette was paired with other abortive defense systems, Per31 and AbiA, the EOP of  $\phi 31$  was reduced to  $< 10^{-10}$  and the level of phage in the culture was lowered below the detection limits of the assay. AA

225

Chen (Y), Ludescher (RD) and Montville (TJ). **Electrostatic interactions, but not the YGNGV consensus motif, govern the binding of pediocin PA-1 and its fragments to phospholipid vesicles.** *Applied and Environmental Microbiology* 63(12); 1997; 4770-4777

The purpose of this study was to characterize in detail the binding of pediocin PA-1 and its fragments to target membranes by using tryptophan fluorescence as a probe. Based on a three-dimensional model, 4 synthetic N-terminal pediocin fragments were selected to study the mechanism of the initial step by which the bacteriocin associates with membranes. Binding of pediocin PA-1 to vesicles of phosphatidylglycerol, the major component of *Listeria* membranes, caused an increase in the intrinsic tryptophan fluorescence intensity with a blue shift of the emission max. The Stern-Volmer constants for acrylamide quenching of the fluorescence of pediocin PA-1 in buffer and in the lipid vesicles were 8.83 plus or minus 0.42 and 3.53 plus or minus 0.67 M<sup>-1</sup>, resp., suggesting that the tryptophan residues inserted into the hydrophobic core of the lipid bilayer. The synthetic pediocin fragments bound strongly to the lipid vesicles when a patch of positively charged amino acid residues (K-11 and H-12) was present but bound weakly when this patch was mutated out. Quantitative comparison of changes in tryptophan fluorescence parameters, as well as the dissociation constants for pediocin PA-1 and its fragments, revealed that the relative affinity to the lipid vesicles paralleled the net positive charge in the peptide. The relative affinity for the fragment containing the YGNGV consensus motif was 10-fold lower than that for the fragment containing the positive patch. Furthermore, changing the pH from 6.0 to 8.0 decreased binding of the fragments containing the positive patch, probably due to deprotonation of this



residues. These results demonstrate that electrostatic interactions, but not the YGNGV motif, govern pediocin binding to the target membrane. AA

## Bacteria

226

Solaiman (DKY) and Somkuti (GA). **Characterization of pER371-based *Streptococcus thermophilus*-*Escherichia coli* shuttle vectors.** *Biotechnology Letters* 19(7); 1997; 595-598

Native plasmid of *Streptococcus thermophilus* ST137, pER371 (2.7 kb) linearized at various unique restriction sites was individually subcloned into *Escherichia coli* plasmid pUC19 to generate the pUER-series recombinants. A selection cassette consisting of chloramphenicol- and erythromycin-resistance genes was spliced into each construct to generate the pMEU shuttle vectors. Electrotransformation of *Streptococcus thermophilus* with these vectors showed that a ca. 1.7kb BstEII/BanII fragment is essential for plasmid replication. A shuttle vector, pMEU14'-1 (5.3 kb), was constructed using the minimally required fragment for replication. A chloramphenicol acetyltransferase (cat) gene was successfully expressed in the ultimate *S. thermophilus* host by using pMEU 14'-1. Cloning vectors derived from pER371 should provide valuable alternative gene delivery vehicles for the genetic engineering of lactic acid bacteria. AA

227

Bina Desai and Kamat (MY). **Recovery and characterisation of enterotoxigenic strains of *Staphylococci* and microbiological quality of processed Indian foods.** *Journal of Food Science and Technology (India)* 35(5); 1998; 461-464

Various processed food samples were examined for enterotoxigenic *Staphylococcus aureus*, coliform bacteria, mesophilic, thermophilic, psychrophilic and acid producing microorganisms. A new medium formulated in the laboratory for selective isolation of enterotoxigenic *S. aureus* from foods gave a better recovery than Baird-Parker's ETGPA medium-with respect to the samples tested. *S. aureus* were detected in 73% of the samples tested. All the coagulase positive strains (19) produced  $\alpha$ -hemolysin, were resistant to penicillin-G, erythromycin and tetracyclines. Of the 19 isolates,

15 were resistant to amoxycillin, 3 belonged to phage group III of which two produced enterotoxin B. Of the other 16 non-typable isolates, 3 produced enterotoxin D. All the enterotoxigenic strains were thermonuclease positive. Fifty five percent of the samples analysed had coliforms. Seafoods had the highest mesophilic counts ( $3.7 \times 10^6$  cfu/g and coliform count ( $2.4 \times 10^4$  cfu/g) bakery products and seafoods had highest thermophilic counts ( $5.2 \times 10^3$  cfu/g), dairy foods had highest psychrophilic counts ( $7.2 \times 10^3$  cfu/g) and bakery products followed by seafood had highest *S. aureus* counts ( $6.6 \times 10^4$  and  $1.5 \times 10^4$  cfu/g). AA

## Campylobacter jejuni

228

Ng (L-K), Kingombe (IB), Yan (W), Taylor (DE), Hiratsuka (K), Malik (N), Garcia (MM). **Specific detection and confirmation of *Campylobacter jejuni* by DNA hybridization and PCR.** *Applied and Environmental Microbiology* 63(11); 1997; 4558-4563

## Clostridium perfringens

229

Fach (P) and Popoff (MR). **Detection of enterotoxigenic *Clostridium perfringens* in food and fecal samples with a duplex PCR and the slide latex agglutination test.** *Applied and Environmental Microbiology* 63(11); 1997; 4232-4236

A duplex PCR procedure was evaluated for the detection of *Clostridium perfringens* in food and biological samples and for the identification of enterotoxigenic strains. This method uses 2 sets of primers which amplify in the same reaction 2 different DNA fragments simultaneously: the 283-bp *C. perfringens* phospholipase C gene fragment and the 426-bp enterotoxin gene fragment. Internal primers within the 2 primer sets confirmed the specificity of the method by DNA-DNA hybridization with the PCR products. No cross-reaction was observed with other *Clostridium* sp. or with other bacteria routinely found in food. The detection level was approx.  $10^5$  *C. perfringens* cells/g of stool or food sample. When overnight enrichment culture was used, 10 *C. perfringens* cells/g was detected in 57 artificially contaminated food samples. The duplex PCR is a rapid, sensitive, and reliable method for the



detection and identification of enterotoxigenic *C. perfringens* strains in food samples. AA

## Enterococcus faecium

230

Cintas (LM), Casaus (P), Havarstein (LS), Hernandez (PE) and Nes (IF). **Biochemical and genetic characterization of enterocin P, a novel *sec*-dependent bacteriocin from *Enterococcus faecium* P13 with a broad antimicrobial spectrum.** *Applied and Environmental Microbiology* 63(11); 1997; 4321-4330

Enterocin P is a new bacteriocin produced by *Enterococcus faecium* P13 isolated from a Spanish dry-fermented sausage. Enterocin P inhibited most of tested spoilage and foodborne gram-positive pathogenic bacteria, such as *Listeria monocytogenes*, *Staphylococcus aureus*, *Clostridium perfringens*, and *Clostridium botulinum*. Enterocin P is produced during growth in MRS broth from 16 to 45°C; it is heat resistant (60 min at 100°C; 15 min at 121°C) and can withstand exposure to pH between 2.0 and 11.0, freeze-thawing, lyophilization, and long-term storage at 4 and -20°C. The bacteriocin was purified to homogeneity by ammonium sulphate precipitation, gel filtration, cation-exchange, hydrophobic-interaction, and reverse-phase liquid chromatography. The sequence of 43 amino acids of the N terminus was obtained by Edman degradation. DNA sequencing analysis of a 755-bp region revealed the presence of 2 consecutive open reading frames (ORFs). The first ORF encodes a 71-amino-acid protein containing a hydrophobic N-terminal *sec*-dependent leader sequence of 27 amino acids followed by the amino acid sequence corresponding to the purified and sequenced enterocin P. The bacteriocin is apparently synthesized as a prepeptide that is cleaved immediately after the Val-Asp-Ala residues (positions -3 to -1), resulting in the mature bacteriocin consisting of 44 amino acids, and with a theoretical mol. wt. of 4,493. A second ORF, encoding a putative immunity protein composed of 88 amino acids with a calculated mol. wt. of 9,886, was found immediately downstream of the enterocin P structural gene. Enterocin P shows a strong antilisterial activity and has the consensus sequence found in the pediocin-like bacteriocins; however, enterocin P is processed and secreted by the *sec*-dependent pathway. AA

## Escherichia coli

231

Entis (P). **Direct 24-hour presumptive enumeration of *Escherichia coli* 0157:H7 in foods using hydrophobic grid membrane filter followed by serological confirmation: Collaborative study.** *Journal of AOAC International* 81(2); 1998; 403-418

Fifteen laboratories took part in a collaborative study to validate a method for enumerating *Escherichia coli* 0157:H7. The method is based on use of a hydrophobic grid membrane filter and consists of 24 h presumptive enumeration on SD-39 agar and serological confirmation to yield a confirmed *E. coli* 0157:H7 count. Six food products were analyzed: pasteurized apple cider, pasteurized 2% milk, cottage cheese, cooked ground pork, raw ground beef, and frozen whole egg. The test method produced significantly higher confirmed count results than did the reference method for milk, pork and beef. Test method results were numerically higher than but statistically equivalent to reference method results for cheese, cider and egg. The test method produced lower repeatability and reproducibility values than did the reference method for most food/inoculation level combinations and values very similar to those of the reference method for the remaining combinations. Overall, 94% of presumptive positive isolates from the test method were confirmed serologically as *E. coli* 0157:H7, and 98% of these were also biochemically typical of *E. coli* 0157:H7 (completed test). Corresponding rates for the reference method were 69 and 98%, resp. On the basis of the results of this collaborative study and the precollaborative study that preceded it, it is recommended that this method be adopted official first action for enumeration of *E. coli* 0157:H7 in meats, poultry, dairy foods, infant formula, liquid eggs, mayonnaise, and apple cider. AA

## Lactococcus lactis

232

Leelawatcharamas (V), Chia (LG), Charoenchai (P), Kunajakr (N), Liu (C-Q), Dunn (NW). **Plasmid-encoded copper resistance in *Lactococcus lactis*.** *Biotechnology Letters* 19(7); 1997; 639-643

A 54-kb plasmid (pND306) from *Lactococcus lactis* subsp. *lactis* 1252D encoded resistance to both



Cu<sup>2+</sup> and Sn<sup>2+</sup>. The copper resistance determinant was subcloned on a 12.8-kb *PvuII* DNA fragment and mapped using a number of restriction endonucleases. Six other Cu resistant lactococcal strains were also identified and all contained multiple plasmids. Plasmids in five of these strains showed strong hybridization with a probe made using the 12.8-kb DNA fragment, however no chromosomal homologs were detected. The Cu resistance determinant was further isolated as a 10.6-kb *SphI* fragment and used to construct pND968 that expresses resistance to both copper and nisin. AA

233

O'Sullivan (E) and Condon (S). **Intracellular pH is a major factor in the induction of tolerance to acid and other stresses in *Lactococcus lactis*.** *Applied and Environmental Microbiology* 63(11); 1997; 4210-4215

This study demonstrates that exposure of log-phase *Lactococcus lactis* subsp. *cremoris* 712 cells to mildly acid conditions induces resistance to normally lethal intensities of environmental stresses such as acid, heat, NaCl, H<sub>2</sub>O<sub>2</sub>, and ethanol. The intracellular pH (pH<sub>i</sub>) played a major role in the induction of this multistress resistance response. The pH<sub>i</sub> was dependent on the extracellular pH (pH<sub>0</sub>) and on the specific acid used to reduce the pH<sub>0</sub>. When resuspended in fresh medium, cells were able to maintain a pH gradient even at pH<sub>0</sub> values that resulted in cell death. Induction of an acid tolerance response (ATR) coincided with an increase in the ability of cells to resist change to an unfavorable pH<sub>i</sub>; nevertheless, a more favorable pH<sub>i</sub> was not the sole reason for the increased survival at acid pH<sub>0</sub>. Cells with an induced ATR survived exposure to a lethal pH<sub>0</sub> much better than did uninduced cells with a pH<sub>i</sub> identical to that of the induced cells. Survival following lethal acid shock was dependent on the pH<sub>i</sub> during induction of the ATR, and the highest survival was observed following induction at a pH<sub>i</sub> of 5.9, which was the lowest pH<sub>i</sub> at which growth occurred. Increased acid tolerance during lethal acid stress were not acquired if protein synthesis was inhibited by chloramphenicol during adaptation. AA

### **Listeria monocytogenes**

234

Klein (PG) and Juneja (VK). **Sensitive detection of viable *Listeria monocytogenes* by reverse**

**transcription-PCR.** *Applied and Environmental Microbiology* 63(11); 1997; 4441-4448

Detection of pathogens in contaminated food products by PCR can result in false-positive data due to the amplification of DNA from nonviable cells. A new method based on reverse transcription-PCR (RT-PCR) amplification of mRNA for the specific detection of viable *Listeria monocytogenes* was developed. The expression of 3 *L. monocytogenes* genes, *iap*, *hly*, and *prfA*, was examined to determine a suitable target for amplification of RT-PCR. Total RNA from *L. monocytogenes* was isolated, and following DNase treatment, the RNA was amplified by both RT-PCR and PCR with primers specific for the 3 genes. Amplicon detection was accomplished by Southern hybridization to digoxigenin-labeled gene probes. The levels of expression of these 3 genes differed markedly, and the results indicated that the *iap* gene would provide a good target for development of a specific method for detection of viable *L. monocytogenes* based on RT-PCR amplification. After a 1 h enrichment, the 371-bp *iap*-specific product was detected with a sensitivity of ca. 10 to 15 CFU/ml from pure culture. Detection of the 713-bp *hly*-specific amplicon was ca. 4,000 times less sensitive after 1 h, whereas detection of the 508-bp *prfA* product showed the lowest level of sensitivity, with detection not observed until after a 5 h enrichment period. The amplification of the *iap* mRNA was specific for *L. monocytogenes*. Overall, the assay could be completed in ca. 54 h. The use of RT-PCR amplification for the detection of viable *L. monocytogenes* was validated in artificially contaminated cooked ground beef. Following a 2 h enrichment incubation, the *iap*-specific amplification product could be detected in a cooked meat sample that was originally inoculated with ca. 3 CFU/g. These results support the usefulness of RT-PCR amplification of mRNA as a sensitive method for the specific detection of viable *L. monocytogenes* and indicate that this method may prove useful in the detection of this pathogen in ready-to-eat, refrigerated meat products. AA

### **Salmonella**

235

Gangar (V), Curiale (MS) and D'Onorio (A). **LOCATE enzyme-linked immunosorbent assay for detection of *Salmonella* in food: Collaborative study.** *Journal of AOAC International* 81(2); 1998; 419-437



collaborative study was performed in 27 laboratories to validate the enzyme-linked immunosorbent procedure LOCATE for rapid detection of *Salmonella* in foods. Results were read visually and with a microtiter plate reader. The LOCATE method was compared with the Bacteriological Analytical Manual (BAM)/AOAC International culture method for detecting *salmonella* in 6 foods: milk chocolate, nonfat dry milk, dried whole egg, soy flour, ground black pepper, and ground raw turkey. Two foods-dried whole egg and black pepper-required repeat rounds because insufficient data sets were produced initially (AOAC International stipulates a min. of 15 sets per food type). Each laboratory tested one or more of the 6 foods. A total of 1439 samples were analyzed, and no significant differences ( $P < 0.05$ ) were observed between LOCATE with either visual or reader detection and BAM/AOAC International results. The LOCATE screening method with visual or reader detection is recommended for Official First Action Approval. AA

### ***Yersinia enterocolitica***

236

Bhaduri (S) and Cottrell (B). **Direct detection and isolation of plasmid-bearing virulent serotypes of *Yersinia enterocolitica* from various foods.** *Applied and Environmental Microbiology* 63(12); 1997; 4952-4955

A procedure was developed for direct detection, isolation and maintenance of plasmid-bearing virulent serotypes of *Yersinia enterocolitica* from different food sources. Plasmid-bearing virulent strains of *Y. enterocolitica* representing five serotypes were simultaneously detected and isolated from enriched swab samples of artificially contaminated pork chops, ground pork, cheese, and zucchini, using Congo red binding and low-calcium-response tests. The method was also effective in isolating plasmid-bearing virulent strains of *Y. enterocolitica* from naturally contaminated porcine tongues. Virulence of the strains isolated from these foods was confirmed by PCR, the expression of plasmid-associated phenotypes, and mouse pathogenicity. AA

### **Fungi**

### **Yeasts**

237

Enomoto (K), Nakamura (K), Nagai (K), Hashimoto (T) and Hakoda (M). **Inactivation of food microorganisms by high-pressure carbon dioxide treatment with or without explosive.** *Bioscience, Biotechnology and Biochemistry* 61(7); 1997; 1133-1137

In order to elucidate the sterilization mechanism underlying the explosive decompression system, baker's yeast was pressurized with CO<sub>2</sub>, N<sub>2</sub>O, N<sub>2</sub>, or Ar gas at 40 atm. and 40°C for 4 h, and then explosively discharged. The survival ratio was markedly decreased only by the treatments with CO<sub>2</sub> and N<sub>2</sub>O which are relatively soluble gases in water, suggesting that the microorganisms' death may be highly correlated with gas absorption by the cells. Lower decompression rates to atmospheric pressure, however, led to neither any lower reduction of remaining cells nor any smaller release of total cellular proteins. Furthermore, operating with a longer treatment time and smaller number of repetitions was usually more lethal than with a shorter time and more frequent repetition. From these results, most of the yeast cells appear to have been sterilized during the pressurization process. The spore cells of *B. megaterium* are considered to have been killed in a somewhat different manner, because of their distinct sensitivity to the applied gases. AA

238

Hou (CT). **Characterization of new yeast lipases.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1391-1394

Twenty five yeast lipases, obtained on the basis of their positional specificity against triglycerides, were analysed. Lipase was produced by growing cultures on nutrient medium in the presence of vegetable oil at 25°C for 4 days. Of the 25 new yeast lipases analyzed, 19 showed 1,3-positional specificity and 6 showed random specificity. GS

### ***Saccharomyces cerevisiae***

239

Kumagai (H), Hata (C) and Nakamura (K). **CO<sub>2</sub> sorption by microbial cells and sterilization by high pressure CO<sub>2</sub>.** *Bioscience, Biotechnology and Biochemistry* 61(6); 1997; 931-935



The amount of CO<sub>2</sub> sorbed by microbial cells in a *Saccharomyces cerevisiae*-water system was measured by a gravimetric method with a quartz spring, and the correlation between CO<sub>2</sub> sorption and the sterilization effect of high-pressure CO<sub>2</sub> was investigated. The sterilization rate of *Saccharomyces cerevisiae* by high pressure CO<sub>2</sub> was measured by varying the water content and CO<sub>2</sub> pressure, and analyzed by reaction kinetics. The sterilization rate could be described by a first-order reaction, and the dependence of the sterilization rate constant, k, on the water content and CO<sub>2</sub> pressure was evaluated. The amount of CO<sub>2</sub> sorbed by the microbial cells reached equilibrium at a constant CO<sub>2</sub> pressure within a few minutes and was correlated well with the value of k. In addition, the amount of unfreezable water was measured by DSC as an index of the state of water in the cell-water system, this being considered to be closely related to the amount of CO<sub>2</sub> sorbed by the microbial cells. The value of k increased with increasing water content; however, the increase was only slight for a water content by which free water existed. AA

240

Gasent-Ramirez (JM) and Benitez (T). **Lysine-overproducing mutants of *Saccharomyces cerevisiae* baker's yeast isolated in continuous culture.** *Applied and Environmental Microbiology* 63(12); 1997; 4800-4806

*Saccharomyces cerevisiae* baker's yeast mutants which produce 3 to 17 times as much lysine as the wild type depending on the nitrogen source, have been selected. The baker's yeast strain was grown in a pH-regulated chemostat in minimal medium with proline as the nitrogen source, supplemented with increasing concn. of the toxic analog of the lysine S-2-aminoethyl-L-cysteine (AEC). The lysine-overproducing mutants, which were isolated as AEC-resistant mutants, were also resistant to high external concn. of lysine and to *alpha*-aminoadipate and seemed to be affected in the lysine biosynthetic pathway but not in the biosynthetic pathways of other amino acids. Lysine over production by one of the mutants seemed to be due to, at least, the loss of repression of the homocitrate synthase encoded by the LYS20 gene. The mutant grew slower than the wild type, and its dough-raising capacity was reduced in *in vitro* assays, probably due to the toxic effects of lysine accumulation or of an intermediate produced in the pathway. This mutant can be added as a food

supplement to enrich the nutritive qualities of bakery products, and its resistance to  $\alpha$ -aminoadipate, AEC, and lysine can be used as a dominant marker. AA

## BIOTECHNOLOGY

241

Ndon (UJ) and Dague (RR). **Ambient temperature treatment of low strength wastewater using anaerobic sequencing batch reactor.** *Biotechnology Letters* 19(4); 1997; 319-323

242

Krings (U) and Berger (RG). **Biotechnological production of flavours and fragrances.** *Applied Microbiology and Biotechnology* 49(1); 1998; 1-8

The biotechnological generation of natural aroma compounds is rapidly expanding. Aroma chemicals such as vanillin, benzaldehyde (bitter almond, cherry) and 4-(R)-decanolide (fruity-fatty) are marketed on a scale of several thousand tons per year. Their possible production by single-step biotransformations, bioconversions and de novo synthesis using microorganisms, plant cells or isolated enzymes is shown. The perspectives of bioprocesses for the oxifunctionalisation of lower terpenes by genetically modified organisms and economic aspects are discussed. AA

243

Kumar (V), Wati (L), FitzGibbon (F), Nigam (P), Banat (IM), Singh (D), Marchant (R). **Bioremediation and decolorization of anaerobically digested distillery spent wash.** *Biotechnology Letters* 19(4); 1997; 311-313

A facultative anaerobic pure bacterial culture L-2 capable of growth on 12.5% (vv) diluted digested spent wash supplemented with glucose (10 g/l) was isolated from an Indian distillery. It achieved 31% decolorization and 57% COD reduction after 7 days' incubation. The advantages of using such culture for digested spent wash bioremediation are apparent in providing a realistic approach for decreasing its pollution potential prior to disposal. AA

244

Siller (H) and Winter. **Treatment of cyanide-containing wastewater from the food**



## TISSUE CULTURE

Nil

## FOOD ADDITIVES

### Antioxidants

245

Saito (H) and Ishihara (K). **Antioxidant activity and active sites of phospholipids as antioxidants.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1531-1536

Various compounds, representative of the major functional groups in phospholipids, phosphatidylethanolamine and phosphatidylcholine, were tested for antioxidant activity (AA) in a sardine oil system to determine the relationship between mol. structure and the AA of these compounds. AA was found to be attributable not only to the side-chain amino groups but also to the cooperative effect of the hydroxy group in the side chain. Choline and ethanolamine, side-chain moieties of phospholipids, strongly inhibited increases in peroxide values in a sardine oil mixture during storage; however, phosphatidic acid derivatives and glycerol, also major functional groups of phospholipids, did not show AA. Choline and ethanolamine have hydroxy amines as functional groups; therefore, several model reagents that contained amines and alcohols were assayed to compare the activity of the amino group with that of the hydroxy group. All basic alkylamines examined had AA as decomposers of hydroperoxides. The intramolecular hydroxy group in these amines complemented AA of the amino group. Only intramolecular alcohol, which can donate a proton, showed strong synergistic activity with AA of the basic amines, while protected groups, such as methyl ether and phosphate ester, did not show this effect. AA

246

Rader (JI), Weaver (CM) and Angyal (G). **Use of a microbiological assay with tri-enzyme extraction for measurement of pre-fortification levels of folates in enriched cereal-grain products.** *Food Chemistry* 62(4); 1998; 451-465

### Barley

247

Kristensen (M), Planchot (V), Abe (J-i) and Svensson (B). **Large-scale purification and characterization of barley limit dextrinase a member of the  $\alpha$ -amylase structural family.** *Cereal Chemistry* 75(4); 1998; 473-479

248

Zheng (GH), Han (HL) and Bhatti (RS). **Physicochemical properties of zero amylose hull-less barley starch.** *Cereal Chemistry* 75(4); 1998; 520-524

Zero amylose starch isolated from hull-less barley (HB) showed a typical A-type diffraction pattern. The X-ray analysis suggested that granules of zero amylose (SB94794) and 5% amylose (CDC Candle) HB starches had lower crystallinity than did commercial waxy corn starch. Differential scanning calorimetry showed lower transition temp. and endothermal enthalpies for the HB starches than for the waxy corn starch. The zero amylose HB starch showed a Brabender pasting curve similar to that of waxy corn starch, but with lower pasting and peak temp. and a higher peak viscosity. Noteworthy characteristics of zero amylose HB starch were its low pasting temp. and high paste clarity and freeze-thaw stability, which make this starch useful for many food and industrial applications. AA

### Corn

249

di Gioia (L), Cuq (B) and Guilbert (S). **Effect of hydrophilic plasticizers on thermomechanical properties of corn gluten meal.** *Cereal Chemistry* 75(4); 1998; 514-519



The glass transition temp. ( $T_g$ ) and rheological moduli of plasticized corn gluten meal (CGM) were determined with dynamic mechanical thermal analysis (DMTA). The tested plasticizers were water, glycerol, polyethylene glycols (PEG) 300 and 600, glucose, urea, diethanolamine, and triethanolamine, at concn. of 10-30% (dwb). The  $T_g$  of CGM, measured at 188°C when unplasticized, was lowered by > 100°C plasticizer content, except by PEG 600 and glucose, which showed limited compatibility with CGM proteins. The highest plasticizing efficiency, on a molar basis, was measured with PEG 300 and was attributed to the large number of hydrophilic groups and the high miscibility of this compound with CGM proteins. The change in  $T_g$  due to the plasticizing effect was modeled with the Gordon and Taylor equation, but a better fit of the experimental data was obtained with the Kwei equation. AA

250

Mu (HH), Mu-Forster (C), Bohonko (M) and Wasserman (BP). **Heat-induced fragmentation of the maize waxy protein during protein extraction from starch granules.** . *Cereal Chemistry* 75(4); 1998; 480-483

The starch granule of maize contains a characteristic set of tightly bound polypeptides. Granule-associated polypeptides are typically extracted from starch granules by heating starch granule suspensions at 90-100°C in a detergent such as SDS. Solubilized proteins are recovered by centrifugation and analyzed by gel electrophoresis. Previously identified tightly bound granule intrinsic proteins consist of the 85-kDa starch-branching enzyme IIb, the 76-kDa starch synthase I, and the 60-kD waxy (Wx) protein, also known as granule-bound starch synthase I. However, SDS extracts from starch granules of maize also contain a cluster of proteins ranging in mass between 47 and 32 kDa. Group of granule-associated proteins were analyzed and found that each was recognized by the Wx antibody. A 15 amino acid N-terminal sequence from the 47-kDa polypeptide was identical to the predicted N-terminus of the Wx protein. further analysis revealed that each immunoreactive polypeptide between 47 and 32 kDa was a heat-induced fragmentation product of the Wx protein. Conditions for the extraction of granule proteins were evaluated. Results demonstrated that granule proteins are effectively released by mild extraction (10-min incubation at 72°C). Relative to the Wx protein, starch synthase I and starch

branching enzyme IIb were less susceptible to thermal fragmentation. These results demonstrate that the 85-, 76-, and 60 kDa polypeptides are authentic granule-intrinsic proteins, and that the majority of polypeptides between 47 and 32 kDa are artifacts of high-temp. granule extraction procedures. AA

## Oats

251

Zhang (D), Doehlert (DC) and Moore (WR). **Rheological properties of (1-3),(1-4)- $\beta$ -D-glucans from raw, roasted, and steamed oat groats.** *Cereal Chemistry* 75(4); 1998; 433-438

Effects of hydrothermal treatments (steaming, roasting) of oat grain on  $\beta$ -glucan extractability and rheological properties were tested on oat cvs. with low (Robert) and high (Marion)  $\beta$ -glucan content. Steaming of grain reduced the amount of  $\beta$ -glucan that could be extracted, compared with raw or roasted grain, but the extracts from steamed grain had much greater viscosity. Increased extraction temp. increased the amount and the av. relative mol. mass ( $M_r$ ) value of  $\beta$ -glucan extracted. In boiling water extractions, the av.  $M_r$  values among raw, roasted and steamed oat samples were equivalent, but extracts from steamed oat grain had significantly higher intrinsic viscosity than the extracts from roasted or raw oat grains.  $\beta$ -Glucan sol. purified from steamed grain extracts were very viscous and highly pseudoplastic, as described by the power law equation. Oat  $\beta$ -glucans from steamed samples were more viscoelastic than  $\beta$ -glucans from roasted or raw oat samples. Because viscous properties of  $\beta$ -glucans from boiling water extracts are influenced by hydrothermal treatments without affecting polymer mol. wt., polymer interaction with the solvent must be affected. Steaming may disrupt intramolecular cross-linkings in native  $\beta$ -glucan, allowing a linear chain configuration to generate greater viscosity. AA

## Rice

252

Adhikaritanayake (TB) and Noomhorm (A). **Effect of continuous steaming on parboiled rice quality.** *Journal of Food Engineering* 36(1); 1998; 135-143

A prototype model of a continuous flow steamer was designed and developed taking into consideration



the flow characteristics of high-moisture rough rice through a pipe. The model consisted of a hopper to hold soaked rough rice, a steaming section and an outlet to remove gelatinized rough rice at controlled rate. Regulation of rough rice exposure to steam was achieved by manipulating the settings of the discharge mechanism. Rough rice soaked at 60°C for 5 h and equilibrated overnight was steamed using the device. A 10° inclination of the discharge flap and discharge port area of 28.9 cm<sup>2</sup> was found to give optimum quality of parboiled rice with steam supplied at a rate of 9 kg/h and pressure of 1.5 kg/cm<sup>2</sup>. Under these conditions, the capacity of the steamer was 104.5 kg/h parboiled rice with 14% moisture content (wb). The developed steamer has a capacity of approx. 2.7 times that of conventional steamers with only about one-third of the steam requirement. These results indicate potential applications for reducing the cost of parboiling equipment by precluding the need for large boilers and steaming tanks with elaborate steam distribution systems, in addition to improvements in the quality of the parboiled rice. AA

253

Chen (H), Siebenmorgen (TJ) and Griffin (K). **Quality characteristics of long-grain rice milled in two commercial systems.** *Cereal Chemistry* 75(4); 1998; 560-565

Long-grain rice var. Kaybonnet was milled to 3 degree of milling (DOM) levels in 2 commercial milling systems (a single-break, friction milling system and a multibreak, abrasion and friction milling system) and separated into 5 thickness fractions. For both milling systems, the surface lipid content (SLC) and protein content of the milled rice varied significantly across kernel thickness fractions. SLC was influenced by DOM level more than by thickness, while the protein content was influenced by thickness more than by DOM level. Particularly at the low DOM levels, the thinnest kernel fraction (< 1.49 mm) had higher SLC than the other kernel fractions. protein content decreased with increasing kernel thickness to 1.69 mm, after which it remained constant. In both milling systems, thinner kernels were milled at a greater bran removal rate as indicated by SLC differences between the low and high DOM levels. For rice milled to a given DOM level, the multibreak system produced fewer broken than did the single-break system. AA

254

Kamath (SR) and Proctor (A). **Silica gel from rice hull ash: Preparation and characterization.** *Cereal Chemistry* 75(4); 1998; 484-487

Rice hulls, a waste coproduct of the rice industry, is composed of 20% silica. The objectives of this study were to develop a method to recover silica from rice hull ash and produce silica gel, and to determine the physical and chemical properties of the rice hull silica gel (RHSG) relative to Trisyl 300, a commercial silica gel. Rice hull ash consisting of 61% silica and 36% carbon was dispersed in sodium hydroxide to dissolve the silica and produce a sodium silicate sol. The latter was titrated to pH 7 with 1M sulphuric acid to obtain a gel at neutral pH. The RHSG was aged, washed, and dried under specific conditions to get a final product that was slightly basic and had a moisture content > 65%. Energy dispersive X-ray spectrometry indicated that silicon was the most abundant element present in RHSG and Trisyl 300. Elemental analyses by inductively coupled plasma emission spectroscopy indicated a greater concn. of sodium and sulphur in RHSG relative to that in Trisyl 300. RHSG surface area was 285 m<sup>2</sup>/g, which was slightly more than half that of Trisyl 300 particles; the particle pore dia. was 121 Å, which was more than twice that of Trisyl 300. Fourier transform infrared spectroscopy showed similarities in chemical structures for both the silica gel samples with respect to siloxane bonds, surface silanol groups, and adsorbed water. X-ray diffraction patterns for both the samples showed a broad peak between 15 and 35° 2θ diffraction angle indicating their amorphous nature. Scanning electron micrographs revealed that RHSG particles ranged in sizes from < 5 to > 40 µm, whereas Trisyl 300 particles were smaller, ranging in sizes from < 5 to 25 µm and had a more uniform appearance. Silica gel production from rice hull ash alleviates the rice hull waste disposal problem and creates a commercially viable value-added product. RHSG has wide-ranging applications in a var. of industries such as vegetable oil refining, pharmaceuticals, cosmetics, and paints. AA

255

Reshma (SV) and Ahmad (R). **Natural incidence of aflatoxins in parboiled rice during various stages of processing.** *Journal of Food Science and Technology (India)* 35(5); 1998; 451-454

Ten samples of paddy were analysed mycologically to study the incidence of aflatoxins at various stages



of parboiling. Fungal infection was more in parboiled dried paddy and milled parboiled rice. Extracts from seeds were taken and analysed by using TLC. Of the various stages, the drying stage and the stage preceding milling were shown to harbour aflatoxins, highlighting the impact of drying in the formation of aflatoxins. Three samples were aflatoxin positive and showed levels of aflatoxins, ranging from 20-100 µg/kg at the drying stages and 25-120 µg/kg after parboiling. AA

## Wheat

256

Sasaki (T) and Matsuki (J). **Effect of wheat structure on swelling power.** *Cereal Chemistry* 75(4); 1998; 525-529

Starches were isolated from the endosperm of 12 wheat samples with a wide swelling power range in the wholemeal. Starch amylose content (24.8-34.2%) correlated negatively with the swelling power of isolated starch (18.3-26.9), but starch lipid content showed no such correlation. Higher proportions of long chains (DP greater than or equal to 35) in amylopectins contributed to increased starch swelling. Native starch gelatinization temp. and enthalpy measured by DSC correlated positively with swelling power, which also correlated significantly with the regelatinization enthalpy of retrograded starches stored at 5°C for 2 and 4 wks. AA

257

Gibson (LR), McCluskey (PJ), Tilley (KA) and Paulsen (GM). **Quality of hard red winter wheat grown under high temperature conditions during maturation and ripening.** *Cereal Chemistry* 75(4); 1998; 421-427

High temp. during grain filling has been identified as a major factor in the end-use properties of bread wheat (*Triticum aestivum* L.). The objectives were to assess the effect of high temp. during maturation on the grain characteristics, milling quality, and flour quality of hard red winter wheat. In 3 separate experiments, plants of wheat cv. Karl 92 were subjected to regimes (day-night) of 20-20, 25-20, 30-20, and 35-20°C from 10 and 15 days after anthesis (DAA) until ripeness, and 25-20, 30-20, and 35-20°C from 20 DAA until ripeness. In other experiments, plants of wheat cvs. Karl 92 and TAM 107 were dried at 20 and 40°C, and spikes of Karl 92

were dried at different temp. and humidity conditions to assess the effects on quality of high temp. and drying rates during grain ripening. Flour yield correlated positively with kernel wt. and dia., test wt., and proportion of large kernels. Flour yield decreased as temp. increased and correlated negatively with hardness index and proportion of small grains. High growth temp. and rapid grain desiccation decreased mixing time and tolerance of the flours. The greatest damage occurred when high temp. was maintained continuously from early grain filling until ripeness. Weakening of dough properties by rapid desiccation during ripening suggest that temp., humidity, and possibly soil moisture all contribute to the final quality of bread wheat. AA

258

Sarker (DK), Wilde (PJ) and Clark (DC). **Enhancement of protein foam stability by formation of wheat arabinoxylan-protein crosslinks.** *Cereal Chemistry* 75(4); 1998; 493-499

The foam stability properties of a defined mixed solution of Tween 20 and bovine serum albumin was evaluated as a function of arabinoxylan concn. A marked increase in the foam stability was observed with low concn. of arabinoxylan. Max. improvement in the foam stability was obtained with 0.2-0.3 mg/mL of arabinoxylan. Enhancement of foam stability due to a combination of bulk viscosity changes and surface effects was identified. The relative contribution of arabinoxylan to bulk viscosity and adsorbed layer structure was studied by examination of the properties of thin liquid films and the macroscopic air-water interface. Arabinoxylan reduced the rate of thin film drainage, increased the equilibrium thickness of the films, slowed the lateral diffusion of a fluorescent probe molecule located in the adsorbed layer, and increased the surface elasticity. These data are congruent with arabinoxylan-mediated crosslinking of adsorbed protein. These observations may be of significance in gas retention during breadmaking. In addition, this naturally occurring polysaccharide offers potential for use in the control of protein foam stability. AA

259

Uhlen (AK), Hafskjold (R), Kalhovd (A-H), Sahlstrom (S), Longva (A), Magnus (EM). **Effects of cultivar and temperature during grain filling on wheat protein content, composition, and dough mixing properties.** *Cereal Chemistry* 75(4); 1998; 460-465



Three wheat cvs., Bastian, Polkka, and Tjalve, were grown in growth chambers at 9, 12, 15, 18, and 21°C during grain filling in 1994, 1995, and 1996. The wheat samples were analyzed for protein content and sodium dodecyl sulphate (SDS) sedimentation vol. The mixing properties of sifted flours were determined by mixograph, and the flour protein composition was determined by size-exclusion fast protein liquid chromatography (SE-FPLC). The protein content, sedimentation vol., and mixogram parameters were affected by the temp. during grain filling. The protein content increased as the temp. increased. The sedimentation volumes and the mixograph data showed temp. effects that could not be explained by variation in protein content. The proportion of the polymeric flour proteins increased with increasing temp. Positive correlations were found between the proportion of polymeric proteins and SDS sedimentation vol. and, within each yr., between the proportion of polymeric proteins and mixograph peak time. Negative correlations were found between the proportion of low mol. wt. flour proteins (proportion of fraction IV) and sedimentation vol. The differences in these quality parameters among cvs. exceeded the effect of temp. during grain filling. AA

260

Ruan (R), Ning (S), Song (A), Ning (A), Jones (R), Chen (P). **Estimation of *Fusarium* scab in wheat using machine vision and a neural network.** *Cereal Chemistry* 75(4); 1998; 455-459

A neural network was used to relate color and texture features of wheat samples to damage caused by *Fusarium* scab infection. A total of 55 color and texture features were extracted from images captured by a machine vision system. Random errors were reduced by using av. values of features from multiple images of individual samples. A four-layer backpropagation neural network was used. The percentage of visual scabby kernels (%VSK) estimated by the trained network followed the actual percentage with a correlation coeff. of 0.97; max. and mean absolute errors were 5.14 and 1.93%, resp. A comparison between the results by the machine vision-neural network technique and the human expert panel led to the conclusion that the machine vision-neural network technique produced more accurate detn. of %VSK than the human expert panel. AA

261

Petit-Benvegnen (M-D), Saulnier (L) and Rouau (X). **Solubilization of arabinoxylans from isolated water-unextractable pentosans and wheat flour doughs by cell-wall-degrading enzymes.** *Cereal Chemistry* 75(4); 1998; 551-556

Water-unextractable pentosans (WUP) isolated from the flours of 3 wheat cvs. (Apollo, Soissons, Thesee) were treated with enzymes to solubilize the arabinoxylans. The water-unextractable arabinoxylans from the 3 cvs. had similar susceptibility to solubilization by enzymes: Grindamyl S 100 (GS 100), a commercial preparation for baking, rich in pentosanase activities that originated from an *Aspergillus niger* culture; and 3 endoxylanases (E1, E2, E3), an arabinofuranosidase (Af), a  $\beta$ -glucanase ( $\beta$ G), and a ferulate esterase (FAE) purified from GS100. A cellulase (C) and a pure endoglucanase (eG) from *Trichoderma reesei* were also used. GS100 was able to solubilize high mol. wt. arabinoxylans (HMWAX) from WUP that markedly enhance the viscosity of the reaction mixture supernatants. The endoxylanase E1 was responsible for this solubilizing activity of GS100, whereas E2 and E3 made only a very low contribution. Combining E1 with FAE led to a limited increase in the arabinoxylan-solubilizing effect. Also, enzymes hydrolyzing cellulose and  $\beta$ -glucans slightly improved the arabinoxylan solubilization from WUP when combined with GS 100 or E1, but produced arabinoxylans of lower intrinsic viscosity. Similar effects of the enzymes were observed on arabinoxylan solubilization when applied to dough instead of isolated WUP. AA

262

Delwiche (SR), Graybosch (RA) and Peterson (CJ). **Predicting protein composition, biochemical properties, and dough-handling properties of hard red winter wheat flour by near-infrared reflectance.** *Cereal Chemistry* 75(4); 1998; 412-416

Breadmaking quality in wheat is one of several considerations that plant breeders face when developing new cvs. In routine breeding programs, quality is assessed by small-scale dough-handling and bake tests, and to some extent, by biochemical analysis of gluten proteins. An alternative, not yet fully examined method for wheat flour quality assessment is near-infrared reflectance (NIR) spectrophotometry. The present study was performed on 30 genotypes of hard red winter wheat



grown during two crop yrs. at eight to nine locations in the Great Plains area of the United States. Biochemical testing consisted of measuring protein fractions from size-exclusion HPLC ( $M_r > 100k$ ,  $M_r < 25-100k$ , and  $M_r < 25k$  designated as glutenin, gliadins, and albumin and globulins, resp.), pentosan content, and SDS sedimentation vol. Dough-handling properties were measured on a mixograph and recorded as the time to peak dough development, the peak resistance, the width of the mixing curve, and the width of the curve at 2 min past peak. Partial least squares analyses on diffuse NIR spectra (1,100-2,498 nm) were developed for each constituent or property. When applied to a separate validation set, NIR models for glutenin content, gliadin content, SDS sedimentation vol., and mixograph peak resistance demonstrated reference vs. predicted correlations ranging from  $r = 0.87$  to  $r = 0.94$ . Such models were considered sufficiently accurate for screening purposes in breeding programs. NIR spectra were responsive to each constituent or property at a level higher than expected from a correlation between the constituent or property and protein content (recognizing that protein content is modeled by NIR with high accuracy). AA

263

Robertson (GH) and Cao (T). **Substitution of concentrated ethanol for water in the laboratory washing fractionation of protein and starch from hydrated wheat flour.** *Cereal Chemistry* 75(4); 1998; 508-513

An unprecedented ethanol-based, washing process was used at a laboratory scale to produce both conc. protein and starch fractions from hydrated wheat flour. In this multistep process, flour was first hydrated and mixed to a batter and then chilled and rested. the cold batter was then mixed and washed in chilled and conc. ethanol using a modified device that normally applies the water-based Martin process. Control of the separation was affected by each of these steps. For instance, the hydration of the flour, the time of mixing, the temp. of the wash, the ethanol concn., and the time of washing were influential. The method produced a gluten conc. similar in yield and protein content to that reported for a pilot-scale Martin process but without the need for added salt. Notably, ethanol washing resulted in nonsticky, partially disintegrated curds that dried easily, whereas water washing resulted in a sticky, glutinous, cohesive mass that dried slowly. The process has commercial potential to reduce water

and energy use, reduce wastewater generation and environmental impact, and improve product recovery. The process also has the potential to reduce the capital complexity of the drying step and create convenient opportunities for protein subfractionation. AA

264

Fu (BX), Kovacs (MIP) and Wang (C). **A simple wheat flour swelling test.** *Cereal Chemistry* 75(4); 1998; 566-567

Flour swelling tests have been widely used to assess the intercultural differences in starch properties. This note describes a modified flour swelling test which uses approx. equal to 30 mg of flour. It avoids the use of a high-temp. water bath, and does not require a set of uniform and leak-proof tubes. The modified procedure offers a simpler and more rapid alternative to those previously reported, and provides a similar level of discrimination and precision. It is particularly suitable as a micro-scale early generation test for wheat flour swelling properties. AA

265

Larsson (H) and Eliasson (A-C). **Influence of the starch granules surface on the rheological behaviour of wheat flour dough.** *Journal of Texture Studies* 28(5); 1997; 487-501

The influence of the properties of the starch granule surface on the rheological behaviour of wheat flour doughs was studied in dynamic oscillation measurements (frequency sweep and strain sweep) and in stress relaxation measurements. A flour with a high protein content (15%) was diluted with wheat starch to obtain a protein content of 10%. The granule surface of the substituted starch was modified in 3 different ways: by heat treatment, by adsorption of a wheat protein fraction and by adsorption of lecithin to the granule surface. The effects of these modified starches were compared with the results obtained for nonmodified starch and protein or lecithin (in liposomes) added to the flour. Owing to the low concn. of the added protein and lecithin, no effect was observed when they were added to the bulk of flour. However, as a starch-surface modification the same components influenced the rheological parameters studied. Also the heat-treated starch had an effect on the rheological behaviour. The study established the



importance of the properties of the starch-granule surface in wheat flour dough. AA

## MILLETS

### Corn

266

Yuan (RC) and Thompson (DB). **Freeze-thaw stability of three waxy maize starch pastes measured by centrifugation and calorimetry.** *Cereal Chemistry* 75(4); 1998; 571-573

267

Bae (SO) and Lim (S-T). **Physical properties of extruded strands of hydroxypropylated normal and high-amylose corn starch.** *Cereal Chemistry* 75(4); 1998; 449-454

Normal (25% amylose) and high-amylose (70% amylose) corn starches (CS and HA) were hydroxypropylated to 0.1 degree of molar substitution (MS) with propylene oxide in an alkaline-ethanol medium (70% ethanol). CS and hydroxypropylated corn starch (HPCS) were mixed on dry basis with water and glycerol at a wt. ratio of 7:2:1, and HA and hydroxypropylated high amylose corn starch (HPHA) were mixed at 7:3:1. Stearic acid, glycerol monostearate, or lecithin (3%, based on starch) was added to each mixture to examine the effects on the physical properties of the extrudate. The starch mixtures were extruded at high shear (100 rpm) to nonexpanded strands using a corotating twin-screw extruder in a temp. range of 75-90°C. HA, alone and with all additives, showed lower die swelling in extrusion than did CS, whereas HPCS and HPHA showed higher die swelling than the corresponding unmodified starches. Water absorption of all HA extrudates was lower than those of all CS extrudates (22-35% and 68-97%, resp., at 25°C). Hydroxypropylation increased the absorption for both starches. All extruded starches, regardless of additives, showed low solubility in water (0.1-1.0% for 2 h at 25°C). DSC indicated that during extrusion, the lipid additives formed a helical complex with amylose in CS and HA, but weakly with HPCS and HPHA. The extruded strands of HA, alone and with additives, exhibited higher tensile and bending strengths (37.1-58.4 and 2.16-5.07 Mpa, resp.), compared to the CS strands (12.5-59.3 and 1.06-4.10 MPa, resp.) at the same moisture content (7.5-8.5%). Both tensile strength and percent of

elongation of the starch strands were reduced by the presence of a lipid additive. Hydroxypropylation increased elongation and flexibility of the extrudates. HPHA exhibited the greatest mechanical strength and flexibility among the tested starches. AA

268

Dickey (LC), Dallmer (MF), Radewonuk (ER), Parris (N), Kurantz (M), Craig (JC). **Zein batch extraction from dry-milled corn: Cereal disintegration by dissolving fluid shear.** *Cereal Chemistry* 75(4); 1998; 443-448

Corn particles were extracted in an agitated vessel with a 4:1 mass ratio of 70% ethanol to corn for periods of 1-6 h at ambient temp. The extract solution was filtered and centrifuged to remove suspended particles after extraction and then diluted to 40% ethanol to precipitate extracted solute. Measurements of the mass of suspended particles separated by centrifugation indicate that mixing the corn particles with the ethanol dissolves and weakens the protein between cells and between starch granules within cells near the particles' surface. Under the conditions of this study, corn particles release starch granules more rapidly than the protein bodies dissolve, as indicated by analysis of the centrifuged particles. The diffusion coeff. for ethanol sol. in corn was estimated and compared with a coeff. derived from a fit of the trend in the rate of release of fine particles from the milled corn. The diffusion coeff. of pure zein in a stagnant 70% ethanol sol. was estimated from the measurement of wt. loss by a ball of zein. Analysis of the ambient temp. protein extraction rate indicates that 2-mm particles exhibit more convective mass transfer than 20 µm particles. AA

269

Doner (LW), Chau (HK), Fishman (ML) and Hicks (KB). **An improved process for isolation of corn fiber gum.** *Cereal Chemistry* 75(4); 1998; 408-411

Sequential alkaline extraction and alkaline hydrogen peroxide (AHP) bleaching have been used to prepare corn fiber gum in yields ranging from 21 to 40%, depending on the pH of the extraction medium. The pH was adjusted by using different ratios of NaOH and Ca(OH)<sub>2</sub>. The whitest product was obtained after AHP bleaching of the extract obtained using the lowest pH value. In order for the product gum to give its characteristic clear and low viscosity solutions, it was necessary to remove starch from



the corn fiber substrate using  $\alpha$ -amylase. The water-insoluble hemicellulose A fraction, a minor component, was removed by neutralizing AHP-treated extracts before ethanol precipitation of the useful hemicellulose B (corn fiber gum) fraction. At ambient temp., AHP bleaching was near optimal, after approx. equal to 2 h under the processing conditions used. High ratios of arabinose (39%) to xylose (50%) were present in the corn fiber gum extracted under various alkaline conditions, and the  $H_2O_2$  processing step did not significantly alter these ratios. The same low levels of galactose (7%) and glucuronic acid (4%) were present regardless of the extraction conditions. Mol. mass of the corn fiber gum preparations ranged from  $2.78 \times 10^5$  for the material extracted with  $Ca(OH)_2$  to  $3.94 \times 10^5$  for the material extracted with NaOH. Mol. mass was unaffected by the  $H_2O_2$  present in the second processing step. As expected for a carbohydrate polymer with a rather low uronic acid content, sol. viscosities were unaffected by the presence of salt. AA

270

Lobeira (R), Almeida-Dominguez (HD) and Rooney (LW). **Methods to evaluate hydration and mixing properties of nixtamalized corn flours.** *Cereal Chemistry* 75(4); 1998; 417-420

Rapid Visco Analyser (RVA), consistometer, and mixograph methods were developed to evaluate the pasting, hydration, and mixing characteristics of commercial nixtamalized corn flours (NCF) used for masa production. The effect of moisture level (51-58%) on the mixing characteristics of NCF was evaluated with the mixograph. Masas were subjectively evaluated for machinability properties. Masa with a low moisture level (51%) had reduced mobility and firmer texture, resulting in higher and wider mixograms. The mixograph was able to differentiate between the various stages of masa preparation. The first-stage involves hydration of NCF particles, which causes the force to increase. Then masa develops cohesiveness and reaches max. consistency. Finally, masa develops stickiness due to overmixing, which makes the curve narrower and lower. At a high moisture level (58%), masa is lubricated and plasticized and yields a softer texture with reduced mixing consistency, evident on the mixograph and in lower subjective hardness readings. Flours with higher water absorption capacities produced thick slurries with increased RVA viscosities and shorter consistometer travel distances. Short consistometer travel distances

were significantly correlated to increased initial and max. viscosities in the RVA. The mixograph, RVA, and consistometer methods can be used in NCF quality control programs. AA

271

Arasaratnam (V), Mylvaganam (K) and Balasubramaniam (K). **Corn malt extract for alcoholic and non-alcoholic beverages.** *Journal of Food Science and Technology (India)* 35(5); 1998; 425-427

Malt powder prepared from germinated corn was toasted in an oven at  $50^\circ C$  to increase its flavour. Malt extract was fermented by Baker's yeast and a malty flavoured dark brown coloured, clear alcoholic beverage was obtained. Alcohol strength of the beverage increased and the non-fermented carbohydrate decreased, when the extract was treated with glucoamylase and yeast simultaneously. Non-alcoholic beverage was prepared by mixing conc. malt extract with milk powder, sucrose, cocoa powder and glucose. AA

272

Yokoyama (W), Renner-Nantz (JJ) and Shoemaker (CF). **Starch molecular mass and size by size-exclusion chromatography in DMSO-LiBr coupled with multiple angle laser light scattering.** *Cereal Chemistry* 75(4); 1998; 530-535

The wt. av. molar mass ( $M_w$ ) and root mean square radii of starches from waxy maize (Amioca), waxy rice flour, cassava, Hylon V, Hylon VII, and potato amylose were determined by size-exclusion chromatography (SEC) and multiple-angle laser light scattering (MALLS). Dimethylsulfoxide (DMSO) containing 50 mM LiBr was used to dissolve the starches and also served as the mobile phase. SEC with large particle size polystyrene divinylbenzene packing materials and MALLS instrumentation were evaluated for the ability to separate and determine molar mass (MM) of starch polymers, resp. The detn. of  $M_w$  by MALLS is necessary because the  $M_w$  of many cereal starches exceeds the available mol. standards by one or two orders of magnitude. The  $M_w$  depends on the method of calculation. The  $M_w$  (Berry method) of starch from waxy corn was  $2.27 \times 10^8$  Da, waxy rice  $8.9 \times 10^7$  Da, cassava  $5.7 \times 10^7$  Da, Hylon V  $2.7 \times 10^7$  Da, Hylon VII  $4.8 \times 10^6$  Da, and potato amylose  $1.9 \times 10^5$  Da. Recovery dropped dramatically for molecules with root mean square radii  $> 200$  nm. AA



273

Gopalakrishna (AG), Prabhakar (JV) and Aitzetmuller (K). **Tocopherol and fatty acid composition of some Indian pulses.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1603-1606

The tocopherol and tocotrienol composition of the Indian pulses Bengal gram (*Cicer arietinum* L.) blackgram (*Vigna mungo* L.) green gram (*Vigna radiata* L.) and horse gram (*Dolichos biflorus* L.) were studied. The total tocopherol content ranged from 230 to 1567 mg/100 g fat, while the tocopherol content of the pulses as a whole ranged from 6.76 to 12.54 mg/100 g seed. Presence of such a high amount of tocopherol, both in the oil fraction of Indian pulses and in an oil fraction of a food material, is being reported for the first time. The fatty acid composition of the fat extracted from these pulses showed substantial amounts of unsaturated fatty acids (Bengal gram, 88.7%; black gram, 82.9%; green gram, 64.3%; and horse gram, 66.9%). These pulses contained 3.8 to 49.1% linolenic acid in the fat. AA

## Beans

274

Czuchajowska (Z), Otto (T), Paszczynska (B) and Baik (B-K). **Composition, thermal behavior, and gel texture of prime and tailings starches from garbanzo beans and peas.** *Cereal Chemistry* 75(4); 1998; 466-472

Prime and tailings starches of garbanzo beans and peas were separated and the chemical composition, physical properties, thermal behavior, and gel properties were determined. Starch granules < 35  $\mu$ m were 85% in garbanzo beans, 66.8% in a smooth pea cv. Latah, and only 18.4% in a smooth pea cv. SS Alaska. Amylose content of prime starch was 35.9% in garbanzo beans, 44.5-48.8% in smooth peas, and 86.0% in wrinkled pea cv. Scout. Tailings starch amylose content was at least 8% higher than the corresponding prime starch. The endothermic enthalpy value of garbanzo bean and 2 smooth pea prime starches ranged from 12.1 to 14.2 J/g, while prime starch from wrinkled peas gave a distinctly lower enthalpy value of 1.1 J/g. Differential scanning calorimetry endothermic enthalpy and amylograph

pasting properties of prime starch were significantly related to its amylose content ( $P < 0.05$ ). Prime starches of garbanzo beans and smooth peas produced highly cohesive elastic gels. Wrinkled pea prime starch formed the strongest (though brittle) gel, as indicated by high hardness (21.8 N), low cohesiveness (0.29), and low springiness (0.82). Hardness of gel stored at 22°C and at 4°C was positively correlated with amylose content of starch. AA

## Bengalgram

275

Hend (G) and Pratima Shastri. **Studies on *in vitro* digestibility of some selected Bengalgram products.** *Journal of Food Science and Technology (India)* 35(5); 1998; 445-446

Split bengalgram (*Cicer arietinum*) processed by sand-roasting or frying is a popular snack in India. Heat processing causes changes in carbohydrates and proteins giving a crisp, ready-to-eat product. Present investigation compares the *in vitro* digestibility of starch and proteins in raw and processed split bengalgram products. The *in vitro* carbohydrate digestibility of raw bengalgram starch was 80% compared to gelatinized corn starch and it further decreased on processing. While *in vitro* protein digestibility was 65.2% compared to casein and it improved substantially on processing. Fried product was observed to be less digestible compared to toasted one. AA

## Carob bean

276

Feillet (P) and Roulland (M). **Caroubin: A gluten-like protein isolated from carob bean germ.** *Cereal Chemistry* 75(4); 1998; 488-492

In 1935, Bienenstock and coworkers claimed the presence of gluten-like material in the germ of the carob seed. The viscoelastic properties of the water-insoluble protein isolated from carob germ, called caroubin, have been confirmed by dynamic ( $G'$  and  $G''$ ) and static rheological measurements (texture profile analysis, viscoelastogram). Biochemical analyses showed important similarities (high glutamic acid content, size-exclusion HPLC profile, PAGE patterns of reduced and unreduced proteins) as well as large differences (high arginine and low cysteine and proline content of caroubin,



carbohydrate composition) between caroubin and wheat gluten. Besides potential new industrial uses of carob seed, caroubin could be a valuable material to help to understand the physicochemical basis of the viscoelastic properties of plant protein complexes like wheat gluten. AA

### Green peas

277

Juhl (HJ), Bech (AC), Kristensen (K), Poulsen (CS) and Hansen (M). **Consumer involvement and evaluation of green peas.** *Journal of Sensory Studies* 13(1); 1998; 1-11

This paper reports the effect of consumer involvement on overall acceptance of frozen peas used in green salad and the effect of consumer involvement on the consumer's ability to perceive variations in a set of physical/chemical characteristics such as AIS (alcohol insoluble solids) and colour. The results reveal that consumers with high involvement evaluate 16 experimentally varied pea samples more in accordance with quality indicators used in the industry than consumers with low involvement. In this study 61% of the consumers were highly involved. For low involved consumers there was no relation between av. acceptance and the quality indicators used by producer/retailer and retailer/consumer. High involved consumers could identify more of the physical/chemical variation in the pea samples than the low involved consumers. The results stress the importance of a preliminary segmentation of consumers. The involved consumers do not seem to have any specific preferences for any of the samples included in the study although samples are varied considerably with respect to size, colour and amount of sucrose. It may be considered as indifference. An obvious conclusion to draw from the results of this study is to conc. on the highly involved consumers in further product development. AA

### Parkia

278

Longvah (T) and Deosthale (YG). **Nutrient composition and food potential of *Parkia roxburghii*, a less known tree legume from northeast India.** *Food Chemistry* 62(4); 1998; 477-481

The nutrient compositions of *Parkia roxburghii* kernels and pods (i.e. tender, immature and mature) were determined. Protein content of the kernel was 29% and that of pods 13-19%. Similarly, fat content was highest (34%) in the kernel and ranged from 1-16% in the pods. Unsaturated acids oleic, linoleic and linolenic acids made up 63-68% of the total fat in the pods as well as the kernels. The total essential amino acids amounted to 33%, 36% and 39% in the tender, immature, mature pods, resp., and 42% in the kernels. The essential amino acid pattern of the kernel was comparable to the FAO/WHO/UNU (1985) amino acid requirement for preschoolers. However, the amino acid scores of the tender, immature and mature pods were 64, 84 and 92, resp., with sulphur amino acids as the limiting amino acids in all the pod samples. AA

## OILSEEDS AND NUTS

### Rapeseeds

279

Naczek (M), Amarowicz (R), Sullivan (A) and Shahidi (F). **Current research developments on polyphenolics of rapeseed/canola: A review.** *Food Chemistry* 62(4); 1998; 489-502

The utilization of rapeseed/canola as a source of food-grade proteins is still limited due the presence of glucosinolates, phytates, hulls and phenolics. Phenolic acids and condensed tannins are the predominant phenolic compounds found in rapeseed. The content of phenolic compounds in rapeseed/canola products is much higher than that found in corresponding products from other oleaginous seeds. Phenolics such as free phenolic acids, sinapines and condensed tannins may contribute to the bitter taste and astringency of rapeseed products. In addition, both phenolic acids and condensed tannins may form complexes with proteins, thus lowering the nutritional value of rapeseed products. The specific mode of interaction of rapeseed phenolics with proteins is still not well understood. Therefore, a better knowledge of factors which influence the interactions between phenolics and proteins would be beneficial in developing more efficient technologies for production of phenolic-free rapeseed protein isolates. AA



## Soybeans

280

Wang (T), Hammond (EG) and Fehr (WR). **Phospholipid fatty acid composition and stereospecific distribution of soybeans with a wide range of fatty acid composition.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1587-1594

Phospholipid (PL) fatty acid composition and stereospecific distribution of 25 genetically modified soybean lines with a wide range of compositions were determined by gas chromatography and phospholipase A<sub>2</sub> hydrolysis. PL contained an av. of 55.3% phosphatidylcholine, 26.3% phosphatidylethanolamine, and 18.4% phosphatidylinositol. PL class proportions were affected by changes in overall fatty acid composition. PL fatty acid composition changed with oil fatty acid modification, especially for palmitate, stearate, and linolenate. Stereospecific analysis showed that saturated fatty acids were primarily located at the sn-1 position of all PL, and changes of the saturates in PL were largely reflected on this position. Oleate was distributed relatively equally between the sn-1 and sn-2 positions. Linoleate was much more conc. on sn-2 than on sn-1 position for all PL. Linolenate was distributed relatively equally at low concn. but preferred sn-2 position at high concn. AA

## Soy products

### Soy proteins

281

Dybowska (BE) and Fujio (Y). **Optical analysis of glucono- $\delta$ -lactone induced soy protein gelation.** *Journal of Food Engineering* 36(1); 1998; 123-133

A new method for the investigation of the gelation behavior of soy proteins is proposed. Soy protein isolate was used to prepare a soy protein sol. and glucono- $\delta$ -lactone was used as a coagulant. L\*, a\* and b\* values of the CIE 1976 (L\*a\*b\*) system were continuously monitored with a colorimeter. The stability of this system was confirmed with 13 replicates of control soy protein dispersion. Nine replicates of soy protein sol. with coagulant under the same conditions were carried out to estimate the observation error. It may be possible to use L\*, a\* and b\* values as a reliable measure of the change within the aggregation/gelation process due to the

large change with a small variability given by L\*, a\* and b\* values. Change in structure during each step of the process were revealed by Scanning Electron Microscopy and were consistent with the results from the surface color measurements. AA

282

Boatright (WL) and Crum (AD). **Odour and flavour contribution of 2-pentyl pyridine to soy protein isolates.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1575-1581

Total lipid extracts from soy protein isolates (SPI) were examined to determine the compounds contributing significant odours. The importance of them to the flavour of SPI was also investigated. of the 4 major odour compounds identified 2-pentyl pyridine was found in 2 SPI (0.28 and 1.01 ppm), combined with its repulsive flavour profile (throat-catching and grassy in water) and extremely low flavour threshold level (0.000012 ppm), make it a major contributor to the undesirable flavour of SPI. BV

## TUBERS AND VEGETABLES

### Vegetables

283

Ben-Amotz (A) and Fishler (R). **Analysis of carotenoids with emphasis on 9-*cis*  $\beta$ -carotene in vegetables and fruits commonly consumed in Israel.** *Food Chemistry* 62(4); 1998; 515-520

### Carrots

284

Litvin (S), Mannheim (CH) and Miltz (J). **Dehydration of carrots by a combination of freeze drying microwave heating and air or vacuum drying.** *Journal of Food Engineering* 36(1); 1998; 103-111

Carrot slices were dried by combining freeze drying with a short microwave treatment and air or vacuum drying. Total drying time, and quality parameters including color, dimensions of slices and rehydration ratio were determined. Freeze drying for 2 h at a plate temp. of 30°C followed by 1.5 h at 55°C was sufficient to remove all water by sublimation and reach a product moisture of about 40%. The partially



freeze dried product was microwave treated for 50 s and then dried to 5% moisture in vacuum or forced air. The color, dimenns and rehydration ratio of the partially freeze dried, microwave treated and air dried product were similar to same quality parameters of the product freeze dried to the final moisture content. Final drying in vacuum oven had some beneficial effect on color. A considerable saving in freeze drying time was achieved by combining freeze drying with microwave treatment followed by air drying. Total freeze drying time at 30°C was 9.5 h as compared to a combination of 3.5-3.75 h of partial freeze drying followed by short microwave treatment and 3.75 h air drying. AA

285

Kato-Noguchi (H). **Lactate dehydrogenase in fresh-cut carrot shreds stored under low oxygen atmosphere.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 323-325

Carrot (*Daucus carota* L.) root shreds were stored under a continuous flow of 0.5% and 2% O<sub>2</sub> (balance N<sub>2</sub>) or air at 5°C to investigate the effect of low O<sub>2</sub> atm. on respiratory metabolism, particularly on lactate dehydrogenase (LDH) activity and its isozyme composition. Low O<sub>2</sub> atm. caused a decrease in CO<sub>2</sub> production and an increase in lactate concn. and LDH activity compared to air. By day 2, CO<sub>2</sub> production rate decreased 0.4 and 0.5-fold, lactate increased 3.5- and 2.2-fold, and LDH activity increased 2.3- and 1.7-fold in carrot shreds stored in 0.5% and 2% O<sub>2</sub>, resp., compared to samples in air. Based on nondenaturing electrophoresis, LDH isozyme composition analysis revealed five bands consisting of a tetrameric enzyme with subunits encoded by two different *Ldh* genes. Changes in staining intensity of the isozymes indicated that the increase in LDH activity in carrots under low O<sub>2</sub> atm. resulted from increased enzyme synthesis and that there was preferential induction of one *Ldh* gene. These results suggest that lactic acid fermentation may be accelerated more under 0.5% than 2% O<sub>2</sub> atm. due to greater expression to the *Ldh* genes. AA

## Potatoes

286

Illeperuma (C), Schlimme (D) and Solomos (T). **Changes in sugars and activities of sucrose phosphate synthase, sucrose synthase, and invertase during potato tuber (Russet Burbank)**

**reconditioning at 10°C in air and 2.53 kPa oxygen after storage for 28 days at 1°C.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 311-316

Potato tubers (*Solanum tuberosum* 'Russet Burbank') were stored at 1°C in air for 28 days and then transferred to 10°C in either air or 2.53 kPa O<sub>2</sub>. During cold storage there was an increase in sucrose, glucose and fructose. The activities of extractable sucrose phosphate synthase (SPS) and invertase increased by 2.2- and 7.7-fold, resp., during 28 days at 1°C. The activity of sucrose synthase (SS) remained constant at 1°C and was similar to that found in tubers kept continuously at 10°C. With the transfer of tubers from 1 to 10°C, there was an initial sharp rise in respiration which peaked at approx. equal to 7 days, followed by a gradual decline. Sucrose declined rapidly during reconditioning, while glucose and fructose declined more slowly. With the transfer of tubers from 1 to 10°C, the activity of SS increased sharply after 7 days at 10°C, to be followed by a decline to the levels found in control tubers. The activities of both extractable SPS and invertase decreased during reconditioning, reaching the values of the control tubers within approx. equal to 15 days. Low O<sub>2</sub> inhibited the decrease in sugars and suppressed the rise in SS activity, but it did not alter the decrease in SPS and invertase. Western blot analysis showed that the amount of SPS protein remained unchanged at 1 and 10°C. These results indicate that the activity of SPS is regulated by factors other than the amount of its protein. The activities of the above three enzymes showed no changes in tubers kept at 10°C continuously. In control tubers SPS showed the highest activity, followed by SS and invertase. AA

287

Rovedo (CO), Suarez (C) and Viollaz (P). **Analysis of moisture profiles, mass Biot number and driving forces during drying of potato slabs.** *Journal of Food Engineering* 36(2); 1998; 211-231

The drying of shrinking bodies is analysed by numerically solving a drying model in order to obtain a deeper insight into the drying process, calculating moisture profiles and various forms of Biot number. Moisture profiles shows great differences when different units of concn. are used. Calculated Biot numbers do not satisfactorily explain the drying kinetic curves for solids with a high initial moisture content, because the equilibrium curve is not a straight line. Kinetics drying curves are satisfactorily



analysed in terms of variation of total driving force with time, which differs markedly from the corresponding variation of the total driving force in terms of temp., for a pure heat transfer process. AA

## Sugar-beet

288

Arsilan (N) and Kar (F). **Filtration of sugar-beet pulp pectin extract and flow properties of pectin solutions.** *Journal of Food Engineering* 36(1); 1998; 113-122

Sugar-beet pulp pectin extract was vacuum filtered at 25°C and different filtration pressures ( $0.20 \times 10^5$ ,  $0.33 \times 10^5$  and  $0.47 \times 10^5$  Pa). The measurement of the av. specific cake resistance was discussed. The specific cake resistance was dependent on the filtration pressure. The cake compressibility coeff. at 25°C was calculated as 0.389. The correlation between the pressure drop and the av. specific cake resistance showed that sugar-beet pectin forms a compressible filter cake. By using Kieselguhr as a filter aid to increase the filtration efficiency, the effects of varying the precoating amount and the filter aid dose on the av. specific cake resistance of cake at a constant pressure filtration were studied. The effects of temp. and concn. on the viscosity of pectin sol. were examined at 6 different temp. between 20 and 70°C and 4 concn. levels between 0.005 and 0.020 kg l<sup>-1</sup>. The activation energy for viscous flow was in the range 6.69-13.46 kJ mol<sup>-1</sup>. Equations describing the combined effects of temp. and concn. on the viscosity are given. AA

## Tomatoes

289

Lorenzo (MA), Gerhards (C) and Peleg (M). **Imperfect squeezing flow viscosimetry of selected tomato products.** *Journal of Texture Studies* 28(5); 1997; 543-567

The rheological properties of different brands of commercial tomato paste, sauce, puree and ketchup were estimated by imperfect squeezing flow viscosimetry using a wide plate and a shallow container. The tests were performed with polished and grooved surfaces. In both, slip was prominent to such an extent that the equations for lubricated squeezing flow had to be used for the calculation of rheological parameters. Despite its crudeness, the procedure was sensitive enough to consistently

monitor rheological differences between commercial products of different brands in terms of the apparent stress at a given specimen height, the consistency, K and flow index, n, of the pseudoplastic liquid constitutive equation, and the apparent biaxial elongational viscosity,  $\mu_b$  and its strain rate dependency. In tomato paste, the flow behaviour index was approx. the same in all the brands ( $n \sim 0.5$ ), and the values of K and  $\mu_b$  had a linear relationship. Residual forces after relaxation provided an additional textural measure related to the yield stress. Differences between products of different brands could be consistently monitored regardless of whether the test was performed at a fixed specimen height or a preset initial force. AA

## FRUITS

290

Mathioulakis (E), Karathanos (VT) and Belessiotis (VG). **Simulation of air movement in a dryer by computational fluid dynamics: Application for the drying of fruits.** *Journal of Food Engineering* 36(2); 1998; 183-200

An industrial batch-type, tray air dryer was constructed for the drying of several fruits. The air movement inside the drying chamber was simulated by computational fluid dynamics (CFD). The pressure profiles and the air velocities in the drying chamber above the product were determined by CFD and a lack of spatial homogeneity of the air velocities above the product was found. Drying tests of several fruits were conducted and the drying result, expressed as wt. loss fraction, was determined. There was a variation in the degree of the dryness in several trays and the non-uniformity was traced to in certain areas of the chamber. Comparison of data obtained by the CFD and data obtained from the drying tests showed a strong correlation between the drying rate and the air velocity. AA

291

Brusewitz (GH), Rigney (MP) and Anzaldúa-Morales (A). **Fast fourier transformation analysis of the force-displacement curve as a texture method related to fruit morphology.** *Journal of Texture Studies* 28(5); 1997; 503-516

A method is proposed to quantify localized food texture by cutting through a cylindrical sample with



a wire probe in an Instron universal testing machine. For probe wire dia. of 0.10, 0.63, 0.80 and 1.23 mm, finer wire was more sensitive to force changes for the fruit tested but required a preload tension and may not be strong enough for harder materials. A frequency analysis (FFT) was performed on the force-displacement curves generated as the wire penetrated the sample. FFT peak energies were found at frequencies below 4 Hz for both a standard material and fruit. The first energy peak was the narrowest for a nonbiological material and widest for apples and pears. Peaches stored for 28 days had 3 times more FFT energy in the lowest frequency band. AA

## Apples

292

Dixon (J) and Hewett (EW). **Temperature affects postharvest colour change of apples.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 305-310

Loss of green colour (yellowing) in apples (*Malus x domestica* Borkh.) is due to chlorophyll breakdown, an enzyme-mediated reaction conforming to first-order kinetics. Nondestructive measurements of yellowing, using a tristimulus chromameter, were related to chlorophyll content for 'Cox's Orange Pippin' and 'Granny Smith' apples stored at temp. of 0 to 35°C. Yellowing determined by rate constant (k) of total chlorophyll and changes in hue angle, as a function of temp., increased slowly from 0 to 5°C, increased exponentially from 5 to 20°C, reached a max. from 20 to 24°C, then declined at higher temp. Values of k and the rate of change of hue angle were characterized by a modified Arrhenius equation. 'Cox's Orange Pippin' apples harvested early had lower k and lower rates of hue angle change than late-harvested fruit. Values of k and hue angle change of 'Granny Smith' apples differed between yrs. but not between harvests. The method used to characterize the relationship between yellowing and temp. may describe changes in other important quality attributes of apple fruit during storage and shelf life and help evaluate the efficacy of cool-chain handling and storage systems. AA

293

Nieto (A), Salvatori (D), Castro (MA) and Alzamora (SM). **Air drying behaviour of apples as affected by blanching and glucose impregnation.** *Journal of Food Engineering* 36(1); 1998; 63-79

The effect of blanching and/or glucose impregnation at atmospheric pressure or in vacuum on the kinetics of moisture transfer during the first falling rate period of air drying of apple was analyzed. The moisture diffusivity of water (Deff) was strongly decreased by glucose uptake during impregnation step as well as vol. shrinking. Studies of the cell structure using transmission electron microscopy revealed that both pretreatments did not modify in a great extension the cell wall resistance to water flux. AA

294

Saftner (RA) and Conway (WS). **Effects of postharvest calcium and fruit coating treatments on postharvest life, quality maintenance, and fruit-surface injury in 'Golden Delicious' apples.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 294-298

The effects of postharvest pressure infiltration of CaCl<sub>2</sub> sol., fruit coatings and shrink-wrap film treatments of apples (*Malus domestica* Borkh. 'Golden Delicious') on peel injury, quality attributes, respiration and internal atm. after storage at 0°C for 2 to 6 months, and during subsequent ripening at 20°C were investigated. CaCl<sub>2</sub> treatments (0.14 to 0.34 mol.L<sup>-1</sup>) reduced internal and evolved ethylene and softening of fruits, but they also caused distinctive injury to the fruit surface. Following the CaCl<sub>2</sub> treatments with a water rinse and a wax- or shellac-based coating or a shrink-wrap film reduced surface injury in fruits treated with 0.24 or 0.34 mol.L<sup>-1</sup> sol. of CaCl<sub>2</sub> and eliminated injury resulting from a 0.14 mol.L<sup>-1</sup> CaCl<sub>2</sub> treatment. The fruit coatings delayed ripening; as indicated by better retention of fresh mass, green peel colour, titratable acidity and flesh firmness, and the reduced respiration and ethylene production rates that were observed upon transferring the fruits to 20°C. Sequential treatments with CaCl<sub>2</sub> and a shrink-wrap film also reduced fresh mass loss, respiration and ethylene production rates, but had no effect on other quality characteristics. Internal CO<sub>2</sub> levels increased and O<sub>2</sub> and ethylene levels decreased in surface coated fruits during storage at 0°C. Coating fruits without the use of CaCl<sub>2</sub> also delayed ripening though not as well as that for fruits sequentially treated with CaCl<sub>2</sub> and a surface coating. AA

295

Rao (MV), Watkins (CB), Brown (SK) and Weeden (NF). **Active oxygen species metabolism in 'White Angel' x 'Rome Beauty' apple selections resistant and susceptible to superficial scald.**



Fruit from seedlings selected from a population obtained by crossing superficial scald-resistant 'White Angel' and superficial scald-susceptible 'Rome Beauty' apple (*Malus x domestica* Borkh.) were used to investigate the role of oxidative processes in the development of superficial scald. Selections were identified for study based on fruit coloration and scald susceptibility. Plant material had one of the following three physiognomies: 1) red-skinned fruit resistant to scald; 2) red-skinned fruit susceptible to scald; and 3) yellow-skinned fruit susceptible to scald. The concn. of  $\alpha$ -farnesene, conjugated triene (CT) sp.,  $H_2O_2$ , thiobarbituric acid-reactive substances, carbonyl groups, and the activities of superoxide dismutase, guaiacol-peroxidase, and catalase were measured at harvest and during  $0.5^\circ C$  storage. Relationships were poor between scald susceptibility and  $\alpha$ -farnesene and its oxidation products, CT258, CT281, and the CT258/CT281 ratio. Tissue concn. of  $H_2O_2$  were lower in scald-resistant than in scald-susceptible fruit at harvest and after storage, and these lower concn. were associated with less damage to cellular membranes (lipid peroxidation) and proteins (carbonyl group content). Higher activities of the  $H_2O_2$ -degrading enzymes, guaiacol-peroxidases, and catalases, were related to lower  $H_2O_2$  content and lower scald susceptibility. Activities of superoxide dismutase, a  $H_2O_2$ -generating enzyme, were not related to scald susceptibility or storage period. It was hypothesized that fruit susceptibility to scald is strongly influenced by cellular efficiency in metabolizing active oxygen sp. such as  $H_2O_2$ . AA

## Avocadoes

296

Sinyinda (S) and Gramshaw (JW). **Volatiles of avocado fruit.** *Food Chemistry* 62(4); 1998; 483-487

Volatile constituents of avocado mesocarp were isolated by concurrent steam distillation/solvent extraction in the Linkens-Nickerson apparatus using pentaneether as solvent. The extracts which resulted were conc. in a Kuderna-Danish concentrator and analysed using gas chromatography and linked GC-MS employing capillary columns of contrasting polarity. Hydrocarbons (mainly sesquiterpenes) and alkanals

were the predominant constituents present. In the immediate extract of the avocado mesocarp,  $\beta$ -caryophyllene (60%) was the main sesquiterpene, followed by  $\alpha$ -humulene (5.9%), caryophyllene oxide (4.8%),  $\alpha$ -copaene (4.5%) and  $\alpha$ -cubebene as the main hydrocarbons; alkanals were present, but only in low concn. In the extract prepared following storage (2 h) of the mesocarp at room temp.,  $\beta$ -caryophyllene (28.8%) was the main sesquiterpene, followed by  $\alpha$ -copanene (10.7%), a cadinene isomer (8.5%),  $\alpha$ - and  $\beta$ -cubebene (7.7%),  $\alpha$ -farnesene (5.3%) and octane (4.8%) as principal hydrocarbons; decenal (6.3%) and heptenal (3.2%) were the main aldehydes. AA

## Garcinia

297

Antony (JIX), Josan (PD) and Shankaranarayana (ML). **Quantitative analysis of (-)hydroxy citric acid and (-)hydroxy citric acid lactone in *Garcinia* fruits and *Garcinia* products.** *Journal of Food Science and Technology (India)* 35(5); 1998; 399-402

A combined approach of titrimetry and HPLC for the detn. of (-)hydroxy citric acid (HCA), (-)hydroxy citric acid lactone (HCAL) and citric acid using selectively prepared samples of calcium hydroxy citrates with and without the corresponding lactone is described. The method consisted of determining total acids by titrating against standard alkali and citric acid by HPLC in a sample of calcium hydroxy citrate not containing lactone. From the difference in values, HCA contents were calculated. In a sample of calcium hydroxy citrate containing lactone, HCA contents were determined by HPLC. Similarly, HCA content were determined in a corresponding sample after total conversion of lactone to HCA. From the difference in values, HCAL contents were calculated. Thus, both HCA and HCAL standards could be prepared and used in experiments. Finally, HPLC method were employed in the detn. of HCA, HCAL and citric acid in *Garcinia* fruit rinds and *Garcinia* products. AA

## Kiwifruits

298

Abbott (JA) and Massie (DR). **Nondestructive sonic measurement of kiwifruit firmness.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 317-322



Sonic vibrational responses of 149 kiwifruit (*Actinidia deliciosa*) over the range 0-2000 Hz were measured and compared them with Magness-Taylor (MT) penetrometer values. Sonic resonant frequencies and mass were combined to calculate a sonic stiffness (SS) coeff. Coeff. of detn. for SS coeff. (SSC) vs. MT slope and log of MT max. force were 0.88 and 0.86 resp. SSC provided good to excellent classification of kiwifruit into 2 or 3 firmness catagories based on MT max. force values. A combination of amplitudes at several sonic frequencies (SFS) selected by stepwise discriminant analysis or regression tree analysis also provided successful sorting algorithms. Identification of soft kiwifruit was 89%-96% accurate and of firm kiwifruit 83-91%. These conclusions are based on a rather small sampling of kiwifruit of a single source and size, but the results clearly indicate the potential of a nondestructive firmness measurement based on SF vibrations. SRA

## Oranges

299

Shellie (KC) and Mangan (RL). **Navel orange tolerance to heat treatments for disinfesting Mexican fruit fly.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 288-293

## Papayas

300

Foglia (TA) and Villeneuve (P). ***Carica papaya* latex-catalyzed synthesis of structured triacylglycerols.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1447-1450

*Carica papaya* latex (CPL), the principal source of the protease papain, is a plant derived enzyme and it catalyses the lipolysis of triacylglycerols. This latex lipase has a selectivity for short-chain acyl groups as well as a 1,3-glycerol selectivity. The utility of CPL in lipase-catalyzed reactions, specifically the synthesis of low-calorie triacylglycerol analogs are described here. GS

## CONFECTIONERY, STARCH AND SUGAR

### Confectionery

301

Reddy (MM), Yenagi (NB), Rao (M), Srinivasan (CN) and Hanchinal (RR). **Grain and gluten quality of some cultivars of wheat species and their suitability for preparation of traditional south Indian sweet products.** *Journal of Food Science and Technology (India)* 35(5); 1998; 441-444

Wheat var. of *Triticum dicoccum* ('HW-1093; 'NP-200' and 'DDK-1001'). *T. aestivum* ('DWR-162' and 'HD-2189') and *T. durum* ('HD-4502' and 'DWR-185') were studied for their physical, chemical and cooking properties and evaluated for organoleptic qualities of traditional wheat-based sweet products viz., *godhi huggi* and *gulladiki laddu*. Thousand kernel wt. (32.5 to 44.5 g), vol. (46.0 to 55.7 ml) and density (0.7 to 0.8 g/ml) of the grains significantly varied amongst the var. of same sp. *Dicoccums* were relatively rich in proteins (12.5 to 13.7%), total (1.6 to 2.1% and non-reducing sugar contents (1.1 to 1.8%), *Durums* were rich in fat (1.6 to 1.7%) and ash (1.8 to 1.9%). The cooking time of polished grains was lesser by 11 to 12% when compared to whole wheat grains. Polished grains of *dicoccums* took min. cooking time (21 to 23 min). Gluten yield and frying quality of *dicoccums* compared well with *aestivums*. Traditional products of *dicoccums* had relatively better taste, doneness and flavour and suited for both *godhi huggi* and *gulladiki laddu*. Products of *aestivum* had relatively better texture and suitable for preparation of *gulladiki laddu*. AA

### Chocolates

302

Atapattu (C) and Kakuda (Y). **Milk protein functionality in caramel texture.** *Manufacturing Confectioner* 78(9); 1998; 161-169

The objectives of this study were to investigate the effects of processing conditions and sugar/milk protein concn. on the textural properties of caramel and subsequently to study the effects of structural/functional properties of milk proteins on the textural properties of caramel. The results concluded that the texture is controlled both by the distribution pattern of water within the caramel system and milk protein matrices. CSA

303

Doane-Weideman (T), Jackson (P), Messer (D) and Liescheski (P). **Rapid determination of fat percent**



in chocolate, peanut products and milk powder. *Manufacturing Confectioner* 78(9); 1998; 147-152

This paper compares fat detn. in cocoa beans, chocolate liquor, cocoa powder, milk powder and peanut products using supercritical fluid extraction (SFE) with current methods such as Soxhlet and Mojonnier. The data suggests that SFE has a strong correlation with current AOAC- and AOCS-approved methods for gravimetric fat analysis. For the confectionery manufacturing industry SFE is a choice for rapid fat analysis that can meet the needs of incoming raw material inspection and verification, process control and quality control of final products. CSA

304

Johnson (G). **Chocolate tempering: A confectioner's perspective.** *Manufacturing Confectioner* 78(9); 1998; 65-73

Cocoa butter crystallization, chocolate tempering (time, agitation, rate of cooling), chocolate tempering process, methods of tempering (hand tempering, drip-feeding, tempering machines), confirming temper, enrobing and cooling are the various aspects discussed in this article. CSA

305

Weyland (M). **Shelf-life of chocolate and compound coatings.** *Manufacturing Confectioner* 78(9); 1998; 121-124, 126-128, 130-140

The purpose of this paper is to discuss the factors which has impact on the appearance and texture of chocolate and compound coatings so that confectionery manufacturers can gain the max. shelf-life for their products. CSA

306

Rusterholz (K). **Conveying of ingredients in chocolate manufacturing.** *Manufacturing Confectioner* 78(9); 1998; 141-146

Characteristic features of pneumatic and mechanical handling of bulk materials is dealt. The article also discusses that depending on the layout of the production facility, on the throughput rate and on the particle size of the bulk material to be handled, one or the other system is to be adopted. CSA

307

Dyer (W). **Milk chocolate applications: Maintaining quality and solving problems.** *Manufacturing Confectioner* 78(9); 1998; 109-119

The most important criterias to be remembered during chocolate production, chocolate application, storage and delivery of the product to consumers is discussed. CSA

308

Urbanski (J). **Panning: The selection of chocolate and compounds.** *Manufacturing Confectioner* 78(9); 1998; 81-92

The article discusses that the selection of the right chocolate or compound coating is guided by factors like product design requirements, cost and the handling conditions. CSA

309

Stauffer (MB). **Chocolate behaviour: What influences your selection.** *Manufacturing Confectioner* 78(9); 1998; 75-79

The article discusses that it is important to select the chocolate and determine its behaviour in order to see that it complements the end product to be manufactured. CSA

## Cocoa butter

310

Liu (KJ), Cheng (H-M), Chang (R-C) and Shaw (J-F). **Synthesis of cocoa butter equivalent by lipase-catalyzed interesterification in supercritical carbon dioxide.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1477-1482

Among the five lipases tested, lipase IM-20 from *Mucor miehei* was the most effective and specific in synthesizing the cocoa butter product by interesterification. The yields of cocoa butter equivalent were affected by pressure, substrate oil composition, solubility and co-solvent. The best reaction conditions were, reaction pressure at 1500 psi, triglyceride with high content of POP (P, palmitate,; O, oleate) and POO, reaction medium with 5.0% water and reaction temp. at 50°C. GS



311

Junzheng (P) and Changying (J). **General rheological model for natural honeys in China.** *Journal of Food Engineering* 36(2); 1998; 165-168

The viscosities of 46 var. of Chinese natural honeys were measured with a rotational viscometer. It is found that the Newtonian model may be considered as the general rheological model for Chinese natural honeys. The relationship among water content, temp. and viscosity for different honeys may be expressed by  $\eta = 14.2 \times 10^3 \exp(-0.31w - 0.085t)$ . AA

312

Mato (I), Huidobro (JF), Sanchez (MP), Muniategui (S), Fernandez-Muino (MA), Sancho (MT). **Enzymatic determination of L-malic acid in honey.** *Food Chemistry* 62(4); 1998; 503-508

L-Malic acid detn. has been carried out in honey using a direct enzymatic method. The sample sol. was prepared from 2.5 g honey in 100 ml Milli-Q water. The enzymatic detn. was measured spectrophotometrically at 340 nm, using glutamate-oxaloacetate transaminase and L-malate dehydrogenase. The direct method combines precision (CV was 3.5%, at worst), good recovery (100 plus or minus 3.5%), zero interference, simplicity, and low cost (cost was reduced by 50% using a microtest). This direct enzymatic method was applied to 20 floral honeys of Galicia (northwestern Spain) and the results ranged between 94 and 596 mg kg<sup>-1</sup> (mean 246 mg kg<sup>-1</sup>) of L-malic acid, which is in keeping with value ranges obtained by other authors. Different clarifications [as polyvinyl-polypyrrolidone (PVPP), Carrez, Carrez with NaOH, Carrez with KOH, Carrez together with PVPP and activated charcoal] and a pair of controls have also been used but the precision and the recovery of direct enzymatic method of L-malic acid in honey did not improve. AA

## Starch

313

Pan (Z), Zhang (S) and Jane (J). **Effects of extrusion variables and chemicals on the properties of starch-based binders and**

The effects of extrusion variables (moisture, screw speed, and temp.) and chemicals (urea and sodium bicarbonate) on the properties of starch-based binders (water absorption, bulk density, binder yield, expansion ratio, solubility, pH) and processing conditions (die temp. and pressure, feed rate, and specific mechanical energy) were studied using a central composite design. All quadratic regression models, except the models for bulk density and pH, were significant at the P greater than or equal to 0.06 level. These models can predict the binder properties and processing conditions when extrusion variables and the chemical concn. are known. Optimum combinations of the chemical concn. (g/100 g of starch) and extrusion variables to achieve high water absorption in the binders were 15-20 g of urea/100 g of starch, 0-4 g of sodium bicarbonate/100 g of starch, 35-40 g of moisture/100 g of starch, 100-120 rpm screw speed, and 185-215°C barrel temp. The mol. degradation of the starch occurred during extrusion, especially when the moisture content of starch was < 30 g/100 g of starch. AA

314

Bello-Perez (LA), Colonna (P), Roger (P) and Paredes-Lopez (O). **Macromolecular features of amaranth starch.** *Cereal Chemistry* 75(4); 1998; 395-402

High-performance size-exclusion chromatography (HPSEC), static light scattering (SLS) and dynamic light scattering (DLS) techniques were used for the structural characterization of amaranth starch, solubilized in water by microwave heating in a high-pressure vessel. Apparent av. molar mass ( $M_w$ ), gyration radius ( $R_g$ , and hydrodynamic radius ( $R_h$ ) values were obtained from Berry and Zimm treatment of light-scattering data. When heating time increased from 35 to 90 sec, the  $M_w$ ,  $R_g$ , and  $R_h$  decreased, demonstrating a possible polymer degradation due to temp. Apparent  $M_r$  values from HPSEC at 35 sec (27 plus or minus  $2 \times 10^7$  g/mol) and 50 sec (20 plus or minus  $2 \times 10^7$  g/mol) were lower than those determined by SLS (35 sec =  $69 \times 10^7$  g/mol). However, at 70 and 90 sec, the inverse pattern was obtained. The fractal dimensions ( $d_f$ ) from HPSEC study for samples dissolved for 35 (3.26), 50 (3.24), and 70 sec (3.14) are characteristic of a particle that has the internal structure of hard sphere, and for samples dissolved



for 90 sec (2.19) are characteristic of a fully swollen, randomly branched macromolecule. From SLS,  $\bar{d}_r$  decreased with increasing treatment time ( $\bar{d}_r = 2.44, 2.18, 1.50, \text{ and } 1.03$  for 35, 50, 70 and 90 sec, resp.). The particle-scattering factors and Kratky plots, well-suited for studying the internal structure of a macromolecule, showed a sample degradation when treatment time increased. Results from DLS showed bimodal distributions with differences in the peak locations when treatment time increased. The ratio of  $R_G$  to  $R_H(p)$  for samples analyzed were between 0.88 and 1.3: these values are characteristic of a sphere or globular structure. AA

## Sugar

315

Vimala (P) and Indira Kalyanasundaram. **Microbiological quality of sugar: A preliminary study.** *Journal of Food Science and Technology (India)* 35(5); 1998; 438-440

A preliminary survey of 10 samples of sugar from a cross-section of society revealed bacterial numbers ranging from 12 to 11,250 cfu/g and fungal numbers, from 10 to 1050 cfu/g. These microbial numbers are far in excess of the permissible numbers prescribed for sugar in advanced countries. The bacteria included *Alcaligenes eutrophus*, *A. faecalis* and *Leuconostoc mesenteroides* and the fungi, sp. of *Aspergillus*, *Rhizopus*, *Penicillium*, *Cladosporium*, *Curvularia* and non-sporulating colonies. All the 3 bacteria were found to have a high degree of osmotolerance. Invertase activity was tested and confirmed in *Leuconostoc mesenteroides*. AA

## BAKERY PRODUCTS

### Biscuits

316

Piazza (L) and Schiraldi (A). **Correlation between fracture of semi-sweet hard biscuits and dough viscoelastic properties.** *Journal of Texture Studies* 28(5); 1997; 523-541

Semi-sweet hard dough biscuits were considered in the present work which aims at assessing whether biscuit failure mode and dough viscoelastic properties, which depend on the resting time after mixing, can be correlated to one another. Uniaxial

compressions were performed on rested biscuit doughs to determine biaxial extensional viscosities. The experimental data seemed strongly dependent on the compression rate in the 1-20 mm/min range of crosshead speed. The stress growth trend observed for doughs of different resting time showed that the extent of structural recovery increased with resting. The rheological behaviour of dough under higher extensional deformation was evaluated by means of tensile and tensile-relaxation tests, the result of which can be directly related to the sheeting extensional deformation. These data confirmed the picture of dough structural recovery. Rheological investigations were coupled with DSC detn. of the glass transition temp.,  $T_g$ . The higher  $T_g$  found for rested doughs was tentatively attributed to gluten protein polymerisation. It was finally shown that the failure mode of biscuits changes with the resting time after mixing: the longer the rest, the less the biscuit strength. AA

### Bread

317

Nelles (EM), Randall (PG) and Taylor (JRN). **Improvement of brown bread quality by prehydration treatment and cultivar selection on bran.** *Cereal Chemistry* 75(4); 1998; 536-540

Different bran pretreatments and bran cvs. were investigated with the aim of alleviating the adverse effects caused by bran addition in brown (fiber-rich) bread. Three different bran treatments: hydration, wet heat, and wet oxidation, all hydrate bran before its addition to other breadmaking ingredients. Four different bran cvs. were investigated. All treatments improve brown bread quality significantly, resulting in larger, softer loafs. All treatments resulted in an increase in the water absorption of brown bread doughs and a decrease in potentially oxidizable substances (POS) in brans. It is suggested that prehydration treatment activates bran lipooxygenase which oxidizes POS in bran, reducing bran's contribution to brown bread dough. A further reduction of these substances is caused by a washout effect of the treatments. On av. across all bran cvs., the hydration and wet oxidation treatments improved brown bread quality significantly more than the wet heat treatment, which also reduced the bran POS significantly less than the other treatments, probably due to its rapid inactivation of lipooxygenase. The bran cvs. differed significantly in their effects on brown bread quality,



suggesting that bran selection according to cv. should be considered. AA

318

Sapirstein (HD) and Fu (BX). **Intercultivar variation in the quantity of monomeric proteins, soluble and insoluble glutenin, and residue protein in wheat flour and relationships to breadmaking quality.** *Cereal Chemistry* 75(4); 1998; 500-507

A new fractionation procedure based on differential solubility was applied to wheat flour proteins to evaluate the relationship between protein fractions and functionality for breadmaking. Flour was initially extracted with 50% 1-propanol. Monomeric proteins (mainly gliadins) and soluble glutenin contained in the 50% propanol soluble extract were fractionated by selective precipitation of the glutenin by increasing the concn. of 1-propanol to 70%; monomeric proteins remain in the supernatant. Insoluble glutenin in the 50% propanol insoluble residue was extracted using 50% 1-propanol containing 1% dithiothreitol (DTT) at 60°C. Protein in the final residue was extracted using SDS with or without DTT. It comprised mainly Glu-ID high mol. wt. glutenin subunits and nongluten polypeptides. For 7 Canadian cvs. of diverse breadmaking quality, there was relatively little variation in the percentage of flour proteins corresponding to monomeric proteins (48-52%) and residue protein (14-18%). In contrast, intercultivar variation in soluble and insoluble glutenin was substantial, with contents of 10-20% and 12-28% of flour protein, resp. Soluble and insoluble glutenin were also highly correlated with physical dough properties, accounting for 83-95% of the variation of individual dough rheological parameters (except dough extensibility), and approx. equal to 74% of the variation in loaf vol. In contrast, monomeric and residue protein fractions were poorly associated with breadmaking quality. However, among the 4 protein fractions, only residue protein was significantly correlated ( $r = -0.79$ ) with dough extensibility. The flour sample with the highest and lowest concn. of insoluble and soluble glutenin, resp., as well as marginally the lowest concn. of monomeric and residue proteins was Glenlea, a cv. of the Canada Western Extra Strong Red Spring wheat class which characteristically possesses distinctly strong dough mixing properties. AA

319

Vemulapalli (V), Miller (KA) and Hosene (RC). **Glucose oxidase in breadmaking systems.** *Cereal Chemistry* 75(4); 1998; 439-442

The mechanism of glucose oxidase action in breadmaking was investigated by studying the baking performance of glucose oxidase, the active ingredient that it produced, and its effect on the rheological properties of dough. Glucose oxidase improved the loaf vol. of bread made by 45-, 70-, and 90-min fermentation processes. Although the increase in loaf vol. was significant, it was less than that obtained with an optimum level of  $\text{KBrO}_3$ . With the 90-min fermentation process, the crumb grain of bread was similar for loaves oxidized with optimum levels of glucose oxidase or  $\text{KBrO}_3$ . The rheological properties of doughs containing glucose oxidase and doughs containing no oxidant were compared. Doughs made with glucose oxidase had higher  $G'$  and  $G''$  and lower  $\tan \delta$  values than doughs made without an oxidant. Hydrogen peroxide was responsible for a drying effect in doughs. This drying effect of glucose oxidase was reduced significantly by incorporation of free radical scavengers into the dough. AA

320

Delcour (JA), Haesendonck (IPV), Cleemput (G), Rogers (DE) and Hosene (RC). **Partial purification of a water-extractable rye (*Secale cereale*) protein capable of improving the quality of wheat bread.** *Cereal Chemistry* 75(4); 1998; 403-407

Rye water-soluble extracts contain a protein fraction that, when added at low concn. to a straight-dough breadmaking recipe, significantly increased bread vol. Enrichment of the active component is possible by anion-exchange fractionation with diethylaminoethyl-cellulose (DEAE), by ammonium sulphate precipitation, or by using rye bran or shorts milling fractions as the starting material. The active material was not bound to DEAE-cellulose. With ammonium sulphate precipitation, the fractions obtained at 30, 40 and 50% saturation were active in straight-dough baking experiments. Iso-electric focusing revealed that fractions active in breadmaking invariably contained alkaline protein fractions ( $\text{pI} > 7.5$ ). Inactivation of enzyme material by boiling the water-soluble extract from rye destroyed all breadmaking activity. The activity of the bread improver was additive to that of potassium bromate but not to that of ascorbic acid. It was not



counteracted by catalase, showing that it does not work by a mechanism involving the production of hydrogen peroxide. The extract was not able to overcome the detrimental effect on bread quality resulting from mixing dough in a nitrogen atm. AA

## Cakes

321

Fustier (P) and Gelinas (P). **Combining flour heating and chlorination to improve cake texture.** *Cereal Chemistry* 75(4); 1998; 568-570

322

Lahtinen (S), Levola (M), Jouppila (K) and Salovaara (H). **Factors affecting cake firmness and cake moisture content as evaluated by response surface methodology.** *Cereal Chemistry* 75(4); 1998; 547-550

Values of initial fat temp., mixing intensity, mixing time, and mass ratio of fat and sucrose (F/S ratio) were varied in the preparation of fat-sugar cream. The dependence of cake firmness and cake moisture content on these values, the size of sucrose particles, and storage time were studied using response surface methodology. The logarithm of storage time and F/S ratio proved to be the best predictors for both cake firmness and cake moisture content in the creamed cake. An interaction between fat temp. and F/S ratio had a notable influence and size of sucrose particles had a slight influence on cake firmness. Besides logarithm of time and F/S ratio, mixing intensity was the only factor that affected cake moisture content significantly. AA

## Dough

323

Martinez-Anaya (MA) and Jimenez (T). **Rheological properties of enzyme supplemented doughs.** *Journal of Texture Studies* 28(5); 1997; 569-583

The rheological behaviour of doughs made with different commercial amylases, xylanases, lipases, and glucose-oxidase, singly and in mixed combinations was investigated. All doughs showed similar trends when subjected to frequency and strain sweep tests. The elastic and viscous moduli increased with frequency, and showed a nonlinear behaviour for strains between 0.2 and 3%. Phase angle presented a max. at 5 hz in the frequency plot.

Resting of doughs decreased complex modulus and increased loss tangent. Enzyme supplementation resulted in softening and weakening of doughs immediately after mixing, and further effects during resting. Pentosan degrading enzymes caused the main changes, and pure lipase preparations the least significant, when compared with unsupplemented doughs. Glucose-oxidase reduced the softening effect of polysaccharide hydrolysing enzymes. AA

324

Singh (H), Singh (N) and Kaur (K). **Effects of additives and pH on dough development and gas release characteristics of sound and sprouted wheat.** *Journal of Food Science and Technology (India)* 35(5); 1998; 393-398

Studies were conducted to investigate the effects of various additives viz., wet gluten, carboxymethyl cellulose (CMC) and ascorbic acid alone at pH 5.8 and 4.2 on dough development, gas formation and gas retention characteristics of sound, 24 h and 48 h sprouted wheat flours milled from 'HD-2329' cv. using Chopin Rheofermentometer F2. Dough development and gas release properties improved significantly with 24 h sprouting and on addition of gluten. Lowering the pH adversely affected dough development characteristics of sound and sprouted wheat flour. The max. height of CO<sub>2</sub> production, total CO<sub>2</sub> production and retention vol. improved significantly with the change in pH from 5.8 to 4.2 of doughs supplemented with gluten, while reverse was the trend for dough development characteristic. CMC improved the dough characteristics and deteriorated gas release characteristic of sound and 24 h sprouted wheat flour. Reducing pH to 4.2 and addition of CMC showed beneficial effects on the gas release characteristics of all flours. Ascorbic acid at pH 5.8 and 4.2 adversely affected the CO<sub>2</sub> retention vol. of all flours. Sprouting of wheat upto 24 h, addition of wet gluten and subsequently reducing the pH to 4.2 could be used to get a dough with improved dough development and gas release characteristics. AA

325

Masi (P), Cavella (S) and Sepe (M). **Characterization of dynamic viscoelastic behavior of wheat flour doughs at different moisture contents.** *Cereal Chemistry* 75(4); 1998; 428-432



Three different flours were examined to study the influence of moisture content on the dynamic viscoelastic behavior of wheat flour dough. Doughs with moisture contents varying from 43 to 58% were submitted to dynamic testing using a mechanical spectrometer operating in frequency sweep mode, obtaining information about rheological response in the linear viscoelastic range. To characterize the influence of moisture content on the dynamic viscoelastic behavior of wheat flour dough, some hypotheses regarding the functional role of the water molecules were verified by applying reduction procedures of the rheological curves. By shifting the rheological curves along the vertical axis, it was possible to verify that varying the moisture content of the doughs not only changed dynamic properties but also modified viscoelastic response. By applying a reduction procedure similar to that used to estimate the constants of the Williams, Landel, and Ferry equation, the study demonstrated that not only did the viscoelastic response of doughs vary, but that water molecules interfere with the dynamic by which relaxation phenomena take place. Finally, it was proved that the rheological behavior of flour dough is similar to that of conc. polymer sol., and that it can be characterized by using a double reduction procedure, shifting the rheological curves along the vertical and horizontal axes, and obtaining a master curve that can be considered inherently characteristic of viscoelastic behavior. AA

## MILK AND DAIRY PRODUCTS

### Milk

326

Boekel (MAJSV). **Effect of heating on Maillard reactions in milk.** *Food Chemistry* 62(4); 1998; 403-414

Heated milk is subjected to the Maillard reaction; lactose and lysine residues in milk proteins (mainly casein) are the reactants. An overview is given of the early, advanced and final stages of the Maillard reaction as it occurs in milk. The early Maillard reaction is confined to the formation of the protein-bound Amadori product lactulosyllysine. Breakdown of the Amadori product leads to formation of all kinds of advanced Maillard reaction products such as lysylpyrraline, pentosidine, hydroxymethylfurfural, (iso)maltol, furfurals and

formic acid. The content of these compounds in heated milk is, however, very low (with the exception of formic acid), and does not correspond to the breakdown of Amadori product in quantitative terms. The final stage, in which melanoidins (brown pigments) are formed and protein polymerization occurs, is largely unknown from a chemical point of view, let alone quantitatively. The conclusion can only be that not all important compounds are yet identified. Some experimental data for heated milk are given to illustrate the various stages of the Maillard reaction in heated milk. A kinetic analysis of the Maillard reaction is difficult because it is such a complicated reaction with many parallel and consecutive steps; in addition, one of the reactants, lactose, is also subject to another reaction, namely isomerization followed by degradation. The kinetics can be tackled by kinetic, multiresponse modelling, and this approach is illustrated. It appears that the temp. dependence of the (early) Maillard reaction is lower than for the simultaneously occurring isomerization reactions of lactose. The use of several components formed in the Maillard reaction to evaluate the heat intensity given to milk is discussed. AA

327

Prasongsidh (BC), Kailasapathy (K), Skurray (GR) and Bryden (WL). **Kinetic study of cyclopiiazonic acid during the heat-processing of milk.** *Food Chemistry* 62(4); 1998; 467-472

Heat-stability of cyclopiiazonic acid (CPA) incorporated in milk was assessed under different conditions. The CPA residue in milk was analysed by micellar capillary electrophoresis. Three batches of 1 µg CPA/ml contaminated milk were heated at 60, 80 and 100°C for 15-60 min to simulate heat processing employed in the dairy industry. Only 3-9%, 14-18% and 25-30% of CPA were degraded, resp., and degradation followed a pattern of a first-order reaction. Heating the milk for 2 h at 60, 80 and 100°C decreased the CPA level by 9-17%, 20-34% and 49-50% of CPA. Autoclaving the milk or heating canned milk in a retort for 30 min at 120°C led to a loss of 33-36% of CPA. Simulation of heat-treatments used by the dairy industry induced no significant degradation of CPA. The inability of the heat-treatment during milk processing to eliminate the mycotoxin emphasises the serious potentiality of CPA exposure for liquid milk consumers. AA



Famelart (M-H), Chapron (L), Piot (M), Brule (G) and Durier (C). **High pressure-induced gel formation of milk and whey concentrates.** *Journal of Food Engineering* 36(2); 1998; 149-164

Gels from milk conc. [milk and caseinate powder, ultrafiltration (UF) and microfiltration (MF)] and whey conc. (WC) were obtained with high pressure (200 and 400 MPa, 10 and 30 min). The effects of protein concn. (66-114 g kg<sup>-1</sup> for milk and 97-127 g kg<sup>-1</sup> for whey), NaCl addition (0-8 g kg<sup>-1</sup>), sodium citrate addition (0-4 g kg<sup>-1</sup>) and pH (5.2-6.6 for milk and 7-9 for whey) were studied with a Box-Behnken design. Milk supplemented with caseinate powder did not lead to gel formation by pressure. For UF or MF milk conc., a pH decrease towards 5.9 and a protein content increase led to firmer pressure-setgels. Gels of WC were obtained only at pH 9. A pressure increase from 200 to 400 MPa led to firmer gels, while a protein content increase did not. AA

### Milk products

329

Visser (FR) and Taylor (M). **Improved performance of the aromascan A32S electronic nose and its potential for detecting aroma differences in dairy products.** *Journal of Sensory Studies* 13(1); 1998; 95-120

The Aromascan A32S, an "electronic nose", was evaluated for its performance under conditions of total humidity control. Initially, it was shown that the very high concn. of water vapour in the headspace above a var. of food products used for this study, in comparison with the concn. of their aroma compounds, completely determined the response of the instrument's sensors. Differentiation between the food aromas was impossible. Only when the concn. of a non-aqueous analyte was increased to approx. the water vapour concn. was perfect distinction achieved between air samples with and without analyte. It was obvious that the instrument in its original form would not be capable of distinguishing subtle aroma differences as are encountered within one type of product in quality assurance, storage trials, taint studies etc. However, significant modification of the original version of the instrument and of the sample presentation procedure improved its performance. Now it was possible to distinguish in certain cases, not only between water vapour and food aromas, but also

between different samples of the same types of dairy products. These tests were complemented by sensory evaluation by untrained panels. In this form, the Aromascan A32S offers a new vista for successful and reliable application in the food area. AA

### Cheese

330

Wium (H) and Qvist (KB). **Rheological properties of UF-Feta cheese determined by uniaxial compression and dynamic testing.** *Journal of Texture Studies* 28(4); 1997; 435-454

Rheological characteristics of 3 Feta cheeses produced from ultrafiltered milk (UF-Feta cheeses) with different textures were evaluated using uniaxial compression and dynamic testing (strain and frequency sweeps). Stress at fracture was 20-46 kPa, Hencky strain at fracture was 0.20-0.35, modulus of deformability was 176-465 kPa, and work up to fracture was 4.4-6.7 kJ/m<sup>3</sup>, depending on the type of cheese and the strain rate. Stress at a given strain, and stress at fracture increased with strain rate: the slope of the log(stress at fracture) vs. log(initial Hencky strain rate) plot was 0.06-0.21, indicating a partially viscous behaviour. Stress at fracture discriminated between all 3 Feta textures, and Hencky strain at fracture discriminated a Tin Feta texture from two Brick Feta textures at every compression rate. In dynamic testing the complex modulus was 40-173 kPa, and tan (δ) was 0.17-0.25 depending on the type of cheese and the frequency of oscillation. The slope of log(complex modulus) or log(storage modulus) vs. log(frequency) was 0.12-0.14, and the slope of log(loss modulus) vs. log(frequency) was 0.07-0.11 for all 3 types of cheese. The complex modulus from strain and frequency sweeps in the dynamic testing distinguished the Tin Feta texture from the Brick Feta textures, and the phase angle (δ) measured in strain sweep could differentiate the Blue Brick Feta texture from the Red Brick Feta texture in the strain interval 0.0003-0.024. AA

331

Eppert (I), Valdes-Stauber (N), Gotz (H), Busse (M) and Scherer (S). **Growth reduction of *Listeria* spp. caused by undefined industrial red smear cheese cultures and bacteriocin-producing *Brevibacterium linens* as evaluated in situ on**



**soft cheese.** *Applied and Environmental Microbiology* 63(12); 1997; 4812-4817

The undefined microbial floras derived from the surface of ripe cheeses which are used for the ripening of commercial red smear cheeses have a strong impact on the growth of *Listeria* spp. In some cases, these microbial consortia inhibit *Listeria* almost completely. From such undefined industrial cheese-ripening floras, linocin M18-producing ( $\text{lin}^+$ ) and -nonproducing *Brevibacterium linens* strains were isolated and used as single-strain starter cultures on model red smear cheeses to evaluate their potential inhibitory effects on *Listeria* strains *in situ*. On cheeses ripened with  $\text{lin}^+$  strains, a growth reduction of *L. ivanovi* and *L. monocytogenes* of 1 to 2 log units was observed compared to cheeses ripened with  $\text{lin}$  strains. Linocin M18 activity was detected in cheeses ripened with  $\text{lin}^+$  strains but was not found in those ripened with  $\text{lin}$  strains. Study suggest that production of linocin M18 contributes to the growth reduction of *Listeria* observed on model red smear cheeses but is insufficient to explain the almost complete inhibition of *Listeria* caused by some undefined microbial floras derived from the surface of ripe cheeses. AA

332

Ordóñez (AI), Ibanez (FC), Torre (P), Barcina (Y) and Perez-Elortondo (FJ). **Application of multivariate analysis to sensory characterization of ewe's milk cheese.** *Journal of Sensory Studies* 13(1); 1998; 45-55

333

Wium (H), Gross (M) and Qvist (KB). **Uniaxial compression of UF-Feta cheese related to sensory texture analysis.** *Journal of Texture Studies* 28(4); 1997; 455-476

334

Garde (S), Gaya (P), Medina (M) and Nunez (M). **Acceleration of flavour formation in cheese by a bacteriocin-producing adjunct lactic culture.** *Biotechnology Letters* 19(10); 1997; 1011-1014

Bacteriocin-producing *Enterococcus faecalis* INIA 4 was used as adjunct lactic culture at inoculum levels ranging from 0.003% to 0.10% in the manufacture of semi-hard cheese. Cheese made from milk with 0.003% adjunct culture had the most pronounced proteolysis and developed a characteristic cheese flavour faster than the rest, reaching in 30.4 days the

flavour intensity score of a 45-day control cheese made without adjunct culture. AA

335

Picon (A), Gaya (P), Medina (M) and Nunez (M). **Proteinases encapsulated in stimulated release liposomes for cheese ripening.** *Biotechnology Letters* 19(4); 1997; 345-348

Chymosin, a neutral proteinase from *Bacillus subtilis* and cardoon cyprosin, were co-encapsulated with phospholipase C in stimulated release liposomes. Encapsulated enzymes were added separately to milk to make cheese. Chymosin and the neutral proteinase accelerated  $\alpha_s$ -casein degradation in comparison with control cheese, whereas  $\beta$ -casein degradation was accelerated by neutral proteinase and cyprosin. Neutral proteinase yielded the highest increase in soluble nitrogen. Cheese flavour intensity was enhanced by the neutral proteinase and cyprosin but not by chymosin. AA

### Mozzarella cheese

336

Tunick (MH) and Malin (EL). **Differential scanning calorimetry of water buffalo and cow milk fat in Mozzarella cheese.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1565-1568

The thermal profiles of the fat in Mozzarella cheeses (MC) made from cow milk (CM) and water buffalo milk (WBM) were obtained by differential scanning calorimetry (DSC). The DSC curves of MC made from WBM were distinguishable from those of CM. The curves resembled those of the corresponding milk fats and could be divided into low-, medium-, and high-temp. melting regions. The valley in the curve between the low- and medium-temp. melting regions was at 10.8°C in WBM cheese and below 10°C in CM cheese. In the WBM cheese, the area of the low-melting region was larger than the area of the medium-temp. melting region, but the 2 areas were equal in the CM cheeses. Mixtures of the 2 cheeses exhibited temp. and area values between those of the pure cheeses. Milk-fat mixtures showed similar behavior. The contrasting DSC melting profiles provide a way of distinguishing between 2 MC types and for detecting mixtures of the 2 fats in MC. AA



337

Patidar (SK) and Prajapati (JB). **Standardisation and evaluation of lassi prepared using *Lactobacillus acidophilus* and *Streptococcus thermophilus***. *Journal of Food Science and Technology (India)* 35(5); 1998; 428-431

Combination of *Lact. acidophilus* and *Strep. thermophilus* was used to prepare lassi from standardised mixed milk. In the first part of the study, the strain of *Lact. acidophilus* was selected and the level of sugar and the type of stabiliser were decided. The final product was made by fermenting milk having 10% sugar and 0.05% stabiliser, consisting of sodium alginate and guar gum with *Lact acidophilus* strain 14 (intestinal isolate) and *Strep. thermophilus* MD2. The fresh product had titratable acidity of 0.83% and sensory score of 17.5 out of 20. During refrigerated (at about 7°C) storage, the acidity increased and the sensory score decreased gradually. However, it remained acceptable up to 27 days (1.05% lactic acid and 14.9 sensory score). The lassi samples packed in bottles were more acceptable than those packed in LDPE pouches. The viscosity was 171.7 cp. The count of streptococci was  $15.85 \times 10^4$  cfu/g and that of lactobacilli was  $20.4 \times 10^7$  cfu/g in the fresh product, which remained almost unchanged during storage and unaffected by the type of packaging material. AA

## Wheys

338

Twomey (M), Keogh (MK), Mehra (R) and O'Kennedy (BT). **Gel characteristics of  $\beta$ -lactoglobulin, whey protein concentrate and whey protein isolate**. *Journal of Texture Studies* 28(4); 1997; 387-403

The gelation characteristics of  $\beta$ -lactoglobulin, whey protein isolate and whey protein conc. at varying levels of protein (6-11%), NaCl (25-400 mM),  $\text{CaCl}_2$  (10-40 mM) and pH (4.0-8.0) were studied in a multifactorial design. Small scale deformation of the gels was measured by dynamic rheology to give the gel point (°C), complex consistency index (k'), complex power law factor (n') and critical strain ( $\gamma_c$ ). The gel point decreased and turbidity increased with increasing Ca level. The denaturation temp. measured by differential scanning calorimetry was

reduced at higher pH values. Large scale deformation at 20% and 70% compression was measured using an Instron Universal Testing machine. The true protein level had the largest effect on the stress required to produce 20% and 70% compression and on the consistency (k') of the gels. AA

## MEAT AND POULTRY

### Meat

339

Mottram (DS). **Flavour formation in meat and meat products: A review**. *Food Chemistry* 62(4); 1998; 415-424

The characteristic flavour of cooked meat derives from thermally induced reactions occurring during heating, principally the Maillard reaction and the degradation of lipid. Both types of reaction involve complex reaction pathways leading to a wide range of products, which account for the large number of volatile compounds found in cooked meat. Heterocyclic compounds, especially those containing sulphur, are important flavour compounds produced in the Maillard reaction providing savoury, meaty, roast and boiled flavours. Lipid degradation provides compounds which give fatty aromas to cooked meat and compounds which determine some of the aroma differences between meats from different sp. Compounds formed during the Maillard reaction may also react with other components of meat, adding to the complexity of the profile of aroma compounds. For example, aldehydes and other carbonyls formed during lipid oxidation have been shown to react readily with Maillard intermediates. Such interactions give rise to additional aroma compounds, but they also modify the overall profile of compounds contributing to meat flavour. In particular, such interactions may control the formation of sulphur compounds, and other Maillard derived volatiles, at levels which give the optimum cooked meat flavour characteristics. AA

340

Pierard (D), Damme (LV), Moriau (L), Stevens (D) and Lauwers (S). **Virulence factors of verocytotoxin-producing *Escherichia coli* isolated from raw meats**. *Applied and Environmental Microbiology* 63(11); 1997; 4585-4587



PCR for verocytotoxin-producing *Escherichia coli* (VTEC) was positive in 4.6% of 2,440 raw meat samples; only beef, sheep, and venison samples were positive. None of the isolated VTEC strains belonged to serogroup O157. Additional virulence factors were detected in only a minority of strains, suggesting that most of these meat VTEC isolates are not pathogenic. AA

## Beef

341

Shehata (HA), Attia (EL-SA) and Attia (AA). **Effect of some additives on the quality of low-fat cooked emulsion sausage of beef.** *Journal of Food Science and Technology (India)* 35(5); 1998; 447-450

## Products

### Sausages

342

Georgieva (VG) and Akterian (SG). **Experimental study of hydro-aerosol cooling of sausages: Effect of the process factors on the cooling intensity.** *Journal of Food Engineering* 36(2); 1998; 201-210

The objective of the paper was the controllable hydro-aerosol cooling process of scalded and smoked sausages and the effect of the main process factors on the cooling intensity to be studied. The hydro-aerosol medium includes water droplets dispersed in moist air. The total cooling time, cooling rate and surface heat-transfer coeff. were used as indexes for estimating the heat-transfer intensity. The order of the studied process factors ranked by their significance is the following: sausage dia. (1.62), a cooling water temp. (0.14), air-flow velocity (-0.10) and air-flow temp. (0.10). Sensitivity functions are pointed between briskets and they show the change of an intensity index caused by a unit variation of a process factor. The intensity of the studied controllable hydro-aerosol cooling is 1.4-3.8 times higher than the cooling at industrial conditions. The hydro-aerosol cooling can ensure the production of safety, high quality sausages with natural and synthetic covers and their shelf-life to be prolonged. AA

## Poultry

### Chickens

343

Pangas (TK), Sachdev (AK), Ram Gopal and Verma (SS). **Studies on storage stability of fried chicken gizzard.** *Journal of Food Science and Technology (India)* 35(5); 1998; 419-421

Experiments were conducted to observe quality losses in fried chicken gizzard stored under ambient (15 to 21°C, 69 to 82% RH) and at refrigerated (4 plus or minus 1°C, 80% RH) temp. for 7 and 14 days, resp. Non-significant reductions in pH and moisture along with significant ( $P < 0.05$ ) increases in shear force and thiobarbituric acid values were observed. Crude proteins and ether extractives were not significantly affected during ambient storage. However, significant increases in these were noticed in refrigerated samples on the 14th day. Total plate counts (TPC) of raw gizzards decreased during processing. Though the extended storage caused increase in TPC, it was within the permissible limits. The results on the microbial, physico-chemical and sensory properties suggested that fried gizzard could be stored for 7 days at ambient and for 14 days at refrigerated temp. resp., without affecting its eating quality. AA

## SEAFOODS

### Crab

344

Smallwood (AW), Ranieri (TL) and Satzger (RD). **Determination of 4-hexylresorcinol in crab meat.** *Journal of AOAC International* 81(2); 1998; 488-491

A method is described for determining 4-hexylresorcinol (4-Hr) in crab meat. 4-Hr is used to prevent melanosis in shrimp, and the same use has been proposed for crab meat. Because 4-Hr may be added illegally to crab meat as a preservative, consumer protection requires that residues of the compound be monitored in crab meat. 4-Hr is extracted from crab meat with acetonitrile. After dilution with water, the extract is passed through a C<sub>18</sub> solid-phase extraction column and 4-Hr is eluted from the column with ethanol. The compound is determined by reversed-phase liquid



chromatography with diode array detection at 206 nm. Limit of quantitation is 1.0 µg/g. Mean recovery in the range 1-20 µg/g is 89%, with a relative standard deviation of 6.3. AA

## Mussels

345

Draisci (R), Lucentini (L), Giannetti (L) and Boria (P). **Determination of diarrhetic shellfish toxins in mussels by microliquid chromatography-tandem mass spectrometry.** *Journal of AOAC International* 81(2); 1998; 441-447

346

Tavares (M), Mello (MRPDA), Campos (NC), de Moraes (C) and Ostini (S). **Proximate composition and caloric value of the mussel *Perna perna*, cultivated in Ubatuba, Sao Paulo State, Brazil.** *Food Chemistry* 62(4); 1998; 473-475

## Fish

347

Prasad (MM) and Seenayya (G). **Major microbial contamination points (MMP) in fish curing environments of India's Andhra coast.** *Journal of Food Science and Technology (India)* 35(5); 1998; 458-460

Fishes after harvest are contaminated with undesirable microorganisms during the stages of handling and curing. The microbial status of 3 environmental areas like drying ground, soil and sea-sand was assessed to determine the major microbial contamination points (MMP). Certain physical, chemical and microbial quality parameters of the cured fish from the same sites have also been reported. Occurrence of faecal *Streptococci* in more numbers and from more sites than coliforms suggests that they are better indicators of sanitary conditions. Coagulase positive *Staphylococci* were found to occur from drying grounds, soil and in cured product samples. Eighty percent of the cured product samples harboured this bacterium with a mean count of 1.48 log<sub>10</sub> cfu/g of the sample. The order of occurrence of different bacteria from three MMP was found to be drying ground, soil and sea-sand, except faecal coliforms in sea-sand and coagulase positive staphylococci in soil and sea-sand sources. AA

348

Nair (PGV), Ammu (K) and Devadasan (K). **Hypocholesterolemic effects of polyunsaturated fatty acid concentrate prepared from fish oil.** *Journal of Food Science and Technology (India)* 35(5); 1998; 403-407

Hypocholesterolemic effects of a conc. of polyunsaturated fatty acids (PUFAs) prepared from commercially available fish oil were evaluated in albino rats. PUFA conc. containing about 76% of total polyunsaturated acids (36% of docosahexaenoic acid, (DHA) and 23% of eicosapentaenoic acid, (EPA) was incorporated in a hypercholesterolemic diet at 1% level and fed to rats for 2 different periods, viz., one month and three months. The results showed that one month was too short a period for the hypocholesterolemic effects to be manifested. Continuation of the same diet for three months resulted in lowering of serum cholesterol level to about 36% of that in the control group. Cholesterol content of the liver of the animals fed on PUFA-supplemented diet was more than 2 times that of the control group (2.71 and 1.17 g/100 g, resp.). Total lipid content of the liver of the animals also showed a similar trend, suggesting that n-3 PUFA probably would lower serum cholesterol levels by effective redistribution of total cholesterol between serum and tissues. AA

## Products

349

Haraldsson (GG), Kristinsson (B), Sigurdardottir (R), Gudmundsson (GG) and Breivik (H). **The preparation of concentrates of eicosapentaenoic acid and docosahexaenoic acid by lipase-catalyzed transesterification of fish oil with ethanol.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1419-1424

350

Rorback (K) and Jensen (B). **Optimizing headspace sampling temperature and time for analysis of volatile oxidation products in fish oil.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1607-1609

Headspace-gas chromatography (HS-GC), based on absorption to Tenax GR, thermal desorption and GC, has been used for analysis of volatiles in fish oil. To optimize sampling conditions, the effect of heating the fish oil at various temp. and times was



evaluated from anisidine values (AV) and HS-GC. AV indicated sample degradations at 90°C but only small alterations between 60 and 75°C. HS-GC showed increasing response with temp. and time. Purging at 75°C for 45 min was selected as the preferred sampling condition for oxidized fish oil. AA

## PROTEIN FOODS

Nil

## ALCOHOLIC AND NON-ALCOHOLIC BEVERAGES

### Alcoholic beverages

#### Wines

351

Singh (M), Panesar (PS) and Marwaha (SS). **Studies on the suitability of kinnow fruits for the production of wine.** *Journal of Food Science and Technology (India)* 35(5); 1998; 455-457

The optimization of process condition for alcoholic fermentation of kinnow juice to kinnow wine by *Saccharomyces cerevisiae* MTCC 178 is described. The optimal fermentation of kinnow juice was recorded at 30°C temp., pH 4.5 and total soluble solids of 24°Brix with an inoculum level of 14% (v/v). The fermentation of the fruit mash was completed within 4-5 days. A max. ethanol content of 11.3% (v/v) was detected in the kinnow wine under optimized conditions. -AA

### Non-alcoholic beverages

#### Fruit juices

#### Kinnow mandarin juices

352

Ghorai (K) and Khurdiya (DS). **Storage of heat processed kinnow mandarin juice.** *Journal of Food Science and Technology (India)* 35(5); 1998; 422-224

Storage time and temp. had great influence on the quality of heat-processed kinnow mandarin juice. The TSS, ascorbic acid, total carotenoids, acidity, free amino acids, total sugars and soluble proteins of the juice decreased in contrast to non-enzymatic browning and reducing sugars, which increased during 4 months of storage with the increase in temp. and period of storage. But the rate of change was comparatively slow at 3-4°C as against 14°C and 22-31°C. The juice stored at 3-4°C had the highest scores for colour and flavour, irrespective of storage periods. All the juices were acceptable throughout the storage. The storage temp. x period had no significant effect on the colour and flavour of the juice. AA

## FATS AND OILS

353

Shimada (Y), Maruyama (K), Sugihara (A), Moriyama (S) and Tominaga (Y). **Purification of docosa-hexaenoic acid from tuna oil by a two-step enzymatic method: Hydrolysis and selective esterification.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1441-1446

354

Block (JM), Barrera-Arellano (D), Figueiredo (MF) and Gomide (FAC). **Blending process optimization into special fat formulation by neural networks.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1537-1541

Computer programs are used to manage, supervise, and operate production lines of oil, margarine, butter, and mayonnaise in the fats and oils industry. Automation allows for lower-cost and better-quality products. The present paper shows a multilayer perceptron-type, second-generation neural network that was built based on a desirable product solid profile and was designed to formulate fats from three ingredients (one refined oil and two hydrogenated soybean-based stocks). This network operates with three sequential decision levels, technical, availability and costs, to furnish up to nine possible formulations for the desired product. Upgrading verification was accomplished by soliciting to the formulation network all 63 products used in the upgrading (the answers were evaluated by a panel of experts and considered satisfactory) and 17 commercial products. It was possible to formulate more than 50% of the products in the network with



only the three bases available. The results demonstrate the possibility of using neural networks as an alternative to the automation process for the special fats formulation process. AA

355

Zhang (A) and Chen (ZY). **Oxidative stability of conjugated linoleic acids relative to other polyunsaturated fatty acids.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1611-1613

The oxidation of conjugated linoleic acids (CLA) relative to more polyunsaturated fatty acids, including linolenic acid (18:3 n-3, LNA), arachidonic acid (20:4 n-6, AA) and docosahexaenoic acid (22:6 n-3, DHA), in the form of free fatty acids or triacylglycerols, in air at 90°C was studied. CLA both in the form of free fatty acids and triacylglycerols, were extremely unstable to the same extent as DHA, but they oxidized considerably faster than LNA and AA. GS

356

Devineni (N), Mallikarjunan (P), Chinnan (MS) and Phillips (RD). **Supercritical fluid extraction of lipids from deep-fried food products.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1517-1523

A supercritical fluid extraction (SFE) method is described for extracting lipids from fried-food samples. Response surface analysis was used to study the effects of variables, including pressure, temp., flowrate, and modifier (methanol) on lipid extraction by SFE. The analysis of variance for the response variables indicated that the models developed were satisfactory with coeff. of detn. of 0.95 and 0.92 for chicken nuggets and potato fries, resp. The models predicted that increasing the pressure increased the percentage lipid extracted for both chicken nuggets and potato fries. In addition, the pressure by temp. interactions were significant for chicken nuggets and potato fries. Slight differences in fatty acid composition were observed between SFE and the Goldfisch method. The SF extracts contained traces of C<sub>12:0</sub>, C<sub>20:0</sub> and C<sub>24:0</sub> in chicken nuggets and C<sub>14:1</sub>, C<sub>18:3</sub>, C<sub>22:0</sub> and C<sub>23:0</sub> in potato fries, resp., which are not found in the Goldfisch extracts. The optimal conditions for extraction are: 53 MPa, 150°C, 4 mL/min, and 10% modifier for chicken nuggets and 53 MPa, 150°C, 3 mL/min, and 0% modifier for potato fries. To

duplicate the results of exhaustive Goldfisch extraction with petroleum ether, SFE conditions of 44 MPa, 80°C, 3 mL/min, and 0% modifier were used to produce similar results for both chicken nuggets and potato fries. AA

357

Breivik (H), Haraldsson (GG) and Kristinsson (B). **Preparation of highly purified concentrates of eicosapentaenoic acid and docosahexaenoic acid.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1425-1429

358

Ono (M), Hosokawa (M), Inoue (Y) and Takahashi (K). **Water activity-adjusted enzymatic partial hydrolysis of phospholipids to concentrate polyunsaturated fatty acids.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1415-1417

Selective partial hydrolyses of egg yolk phospholipid and squid skin phospholipid were carried out. By keeping the *a<sub>w</sub>* of Lipozyme IM at an intermediate level, it was easy to conc. docosahexaenoic acid (DHA). It was also possible to conc. both DHA and arachidonic acid (AA) simultaneously to a certain level under this *a<sub>w</sub>* range. However, it was impossible to conc. AA alone when DHA was present. Though there is a limitation in concentrating AA exclusively, the proposed *a<sub>w</sub>*-adjusted hydrolytic reaction is a promising way for preparing phospholipids rich in DHA. AA

359

Akoh (CC) and Yee (LN). **Enzymatic synthesis of position-specific low-calorie structured lipids.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1409-1413

An immobilized sn-1,3-specific lipase from *Rhizomucor miehei* (IM 60) was used to catalyze the interesterification of tristearin (C<sub>18:0</sub>) and tricaprin (C<sub>10:0</sub>) to produce low calorie structured lipids (SL). Acceptable product yields were obtained from a 1:1 mole ratio of both triacylglycerols with 10% (w/w of reactants) of IM 60 in 3 mL hexane. The SL mol. sp., based on total C number, were 44.2% C<sub>41</sub> and 40.5% C<sub>49</sub>, with 3.8 and 11.5% unreacted tristearin C<sub>57</sub> and tricaprin C<sub>27</sub>, resp., remaining in the product mixture. The best yield of C<sub>41</sub> sp. (44.3%) was obtained with zero added water. Tricaprylin (C<sub>8:0</sub>) was also successfully interesterified with tristearin in



good yields at 1:1 mol. ratio. Products were analyzed by RP-HPLC with an evaporative light-scattering detector. Reaction parameters, such as substrate mol. ratio, enzyme load, time course, added water, reaction media, and enzyme reuse, were also investigated. Hydrolysis by pancreatic lipase revealed the specific fatty acids present at the sn-1,3 positions of SL. AA

## Oils

360

Narasimhamurthy (K) and Raina (PL). **Studies on the physico-chemical characteristics of some vegetable oils during heating and frying.** *Journal of Food Science and Technology (India)* 35(5); 1998; 432-434

Changes in the physico-chemical characteristics of oils during heating and frying were studied in respect of groundnut, sesame and coconut oils (heating at 180°C for 72 h and frying under laboratory conditions). The results indicated relatively greater alterations in heated oils compared to fried oils. Peroxide value, thiobarbituric acid value, iodine value, conjugated dienoic acid and free fatty acids showed significant changes in heated oils compared to fried oils. The fatty acid analysis showed significant increases in the levels of 16:0, 18:0 and 18:1 and a decrease in the level of 18:2 in both heated and fried oils. AA

361

Coupland (JN) and McClements (DJ). **Physical properties of liquid edible oils.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1559-1564

Literature values of density, viscosity, adiabatic expansion coeff. thermal conductivity, specific heat (constant pressure), ultrasonic velocity, and ultrasonic attenuation coeff. are compiled for a range of food oils and water at 20°C, and a series of empirical equations are suggested to calculate the temp. dependency of these parameters. The importance of these data to the application of ultrasonic particle-sizing instruments to food emulsions is discussed. AA

362

Shankar (D), Agarwal (YC), Sarkar (BC) and Singh (BPN). **Enzymatic hydrolysis in conjunction with conventional pretreatments to soybean for enhanced oil availability and recovery.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1543-1547

Recent studies indicate that enzymatic hydrolysis of oilseeds prior to extraction enhance the extractable oil in oilseeds and its recovery. Optimizing the combination of enzymatic hydrolysis with one or more conventional pretreatments to soybeans and of optimising the hydrolysis parameters as they determine the mechanical extractability as well as the solvent extractability was attempted. Enzymatic hydrolysis in conjunction with flaking (dehulling inherent) and steam conditioning offered the best pretreatment combination for soybean at a 5% level of significance, enhancing the extractable oil content by about 4.8% of moisture-free sample. The optimal hydrolysis parameter values based on response surface analysis were: hydrolysis moisture content 23.22% wet basis, enzyme concn. 11.99 vol/wt., and incubation period 13.79 h. Over 99% of the total extractable oil release after hydrolysis was extractable within 16 h on a soxhlet extractor. BV

363

Engelsen (SB). **Explorative spectrometric evaluations of frying oil deterioration.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1495-1508

The potential of different spectroscopic sensors is evaluated and the advantage of applying multivariate chemometric projection and calibration tools for monitoring the oil deterioration in a commercial frying operation, was demonstrated. Most chemical/physical and all spectroscopic methods detected the deterioration during the first half of the frying cycle. Thereafter, an equilibrium occurred between deterioration processes and replenishment with new oil. Fourier transform infrared (FT-IR) with the attenuated total reflectance sampling technique was the most direct and accurate method of monitoring gross changes in the frying oil. The study also demonstrated that spectroscopic sensors have the potential to replace titration and chromatographic procedures, and can be used in combination with chemometric data analysis to optimize deep-frying operations. GS



364

Mathews (AR), Mahadeviah (M), Gowramma (RV) and Krishnamurthy (MN). **Packaging of raw groundnut oil in tin-free steel cans.** *Journal of Food Science and Technology (India)* 35(5); 1998; 435-437

Studies on groundnut oil packed in tin-free steel and tinsplate containers indicated that there was no significant difference in the peroxide value, free fatty acids and the quality of oil between the 2 types of containers. Large area of iron exposure caused an increase in peroxide value. Incorporation of free fatty acids resulted in the acceleration of peroxide value. AA

### Mustard oils

365

Velasco (L), Fernandez-Martinez (JM) and de Haro (A). **Determination of the fatty acid composition of the oil in intact-seed mustard by near-infrared reflectance spectroscopy.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1595-1602

### Palm oils

366

Jalani (BS), Cheah (SC) and Darus (A). **Improvement of palm oil through breeding and biotechnology.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1451-1455

### Rapeseed oils

367

Henon (G), Kemeny (Zs), Recseg (K), Zwobada (F) and Kovari (K). **Degradation of  $\alpha$ -linolenic acid during heating.** *Journal of the American Oil Chemist's Society* 74(12); 1997; 1615-1617

Degummed bleached rapeseed oil was heated at 210, 220, and 230°C for up to 86 h under reduced pressure with nitrogen stripping. No significant change of total linoleic acid content was found, but a decrease of the total linoleic acid content was observed under extreme conditions. The degradation rate of linolenic acid is described as a function of heating time and operating temp.

Linolenic acid degradation can be predicted for any set of conditions by the established model. No significant degradation of linolenic acid can occur under standard deodorization conditions. AA

### Soybean oils

368

Noureddins (N) and Zhu (D). **Kinetics of transesterification of soybean oil.** *Journal of the American Oil Chemist's Society* 74(11); 1997; 1457-1463

Transesterification of soybean oil with methanol was investigated. Three stepwise and reversible reactions are believed to occur. The effect of variations in mixing intensity (Reynolds number = 3,100 to 12,400) and temp. (30 to 70°C) on the rate of reaction were studied while the molar ratio of alcohol to triglycerol (6:1) and the concn. of catalyst (0.20 wt.% based on soybean oil) were held constant. The variations in mixing intensity appear to effect the reaction parallel to the variations in temp. A reaction mechanism consisting of an initial mass transfer-controlled region followed by a kinetically controlled region is proposed. The experimental data for the latter region appear to be a good fit into a second-order kinetic mechanism. The reaction rate constants and the activation energies were determined for all the forward and reverse reactions. AA

## SPICES AND CONDIMENTS

### Spices

#### Masalas

369

Kalra (CL), Manan (JK), Sehgal (RC), Kulkarni (SG) and Berry (SK). **Studies on the preparation, packaging and analysis of ground spice mixes III: Channa masala and meat masala.** *Journal of Food Science and Technology (India)* 35(5); 1998; 408-413

Thirty samples of channa masala and 35 samples of meat masala of various brands were collected from different markets of North India and evaluated for their chemical composition. Channa masala and meat masala varied widely in their chemical



composition. Channa masala had moisture, 4.00-12.00; total ash, 6.88-34.88; acid insoluble ash, 0.97-2.43; common salt, 3.76-27.81; ether extractives, 5.32-16.27; volatiles, 0.06-0.60; alcohol solubles, 14.05-32.26 and water solubles, 24.56-58.98%. Meat masala had moisture, 5.10-9.20; total ash, 6.27-9.75; acid insoluble ash, 0.26-1.07; common salt, nil; ether extractives, 5.40-18.79; volatiles, 0.04-1.32; alcohol solubles, 11.69-25.10 and water solubles 17.46-36.74%. Channa masala contained higher levels of water solubles and total ash because of the common salt used in its preparation. Frequency distribution histograms have been plotted and quality standards for channa masala and meat masala have been proposed. The ERH of channa masala (initial moisture 8.9%) and meat masala (initial moisture 7.8%) were found to be 46.3% and 50.6%, resp. AA

### SENSORY EVALUATION

370

Ipsen (R). **Uniaxial compression of gels made from protein and  $\kappa$ -carrageenan.** *Journal of Texture Studies* 28(4); 1997; 405-419

Investigations of gels (18% total solids) made from pea protein isolates (PPI) or soy protein isolate (SPI) with differing amounts of  $\kappa$ -carrageenan added showed that the gel strength increased with the concn. of  $\kappa$ -carrageenan. When the concn. of  $\kappa$ -carrageenan exceeded 0.4%, gels made with PPI were stronger and more stiff than equivalent gels made with SPI. Addition of  $\kappa$ -carrageenan stabilized gels made with PPI towards variations in brittleness (indicated by strain at fracture) with pH. This was not the case when SPI was used. Preheating (75°C, 2 min) suspensions containing protein isolates and  $\kappa$ -carrageenan before gel formation increased the strength and stiffness of the final gels, most pronounced when SPI was used. Addition of NaCl (0.5-2%) reduced strength and stiffness of gels, whereas CaCl<sub>2</sub> had no influence on gel properties. Mixtures of PPI and SPI proved to be weaker and more brittle than gels made from only SPI or PPI. Results indicate that using proteins of different origin can cause differences in gel structure. AA

371

Clementi (F), Mancini (M) and Moresi (M). **Rheology of alginate from *Azotobacter vinelandii* in**

**aqueous dispersions.** *Journal of Food Engineering* 36(1); 1998; 51-62

The rheological behaviour of a range of alginate-like polymers produced by *Azotobacter vinelandii* DSM 576 was determined at different alginate concn. (y), temp. (T) and shear rates  $\dot{\gamma}$  in the ranges 0.3-1.5% w/v, 278.16-308.16 K, and 1.1-1400 s<sup>-1</sup>, resp. All aqueous dispersions exhibited the typical pseudoplastic behaviour, that was described by the well known Ostwald-de Waele model. The consistency coeff. ( $K_{ow}$ ) was found to be a complex function of T, y, and number-av. mol. mass ( $M_n$ ) of the biopolymer used. The flow behaviour index (n) showed a hyperbolic reduction with y, thus tending to a limiting value progressively deviating from unity as  $M_n$  increased from 40 to 193 kDalton. By maximising the least squares regression coeff. ( $r^2$ ) up to 0.99, it was possible to reconstruct the experimental apparent viscosities ( $\mu_a$ ) of aqueous dispersions containing either bacterial or algal alginates with a mean standard error of ca. 15%, thus resulting in straightforward estimation of the thickening capability of any alginate, whatever is its algal or bacterial origin based only upon its number-av. mol. mass. AA

372

Briggs (JL) and Steffe (JF). **Using Brookfield data and the Mitschka method to evaluate power law foods.** *Journal of Texture Studies* 28(5); 1997; 517-522

Mitschka proposed a simple technique to calculate av. shear stress and av. shear rate from data obtained with Brookfield viscometers. It allows for estimation of the apparent viscosity, the flow behaviour index, and the consistency coeff. of power law fluids. This method was evaluated for typical shear-thinning foods (banana puree, salad dressing, enchilada sauce and pancake syrup) and found to have excellent potential for quality control testing in the food industry. Results compared favourably with those obtained with a standard cone and plate viscometer. AA

373

Navarro (AS), Martino (MN) and Zaritzky (NE). **Correlation between transient rotational viscometry and a dynamic oscillatory test for viscoelastic starch based systems.** *Journal of Texture Studies* 28(4); 1997; 365-385



Gelatinized starch formulations including lipids and xanthan gum, typical of viscoelastic foodstuffs, were analyzed using a rotational viscometer (transient conditions) and an oscillatory rheometer. Ultra-rapid and slow freezing processing conditions, which can modify product stability, were also tested. Transient shear stress curves showed a typical overshoot and a structural breakdown; the Bird-Leider model satisfactorily fitted these curves. Model parameters were correlated with characteristic peak stress ( $\sigma_{max}$ ), peak time ( $t_{max}$ ) and relative overshoot corresponding to the  $\sigma$  vs. time curve. Relationships between transient shear stress data and dynamic measurements ( $G'$ ,  $G''$ ,  $\delta$ ) for viscoelastic ranges were found for the starch-based systems and were used to assign a physical meaning to Bird-Leider parameters. Viscoelastic starch systems were grouped in different zones of the correlation diagrams based on structure properties like rigidity, stability to the applied strain and fluid characteristics after breakdown. AA

374

Meullenet (J-F), Lyon (BG), Carpenter (JA) and Lyon (CE). **Relationship between sensory and instrumental texture profile attributes.** *Journal of Sensory Studies* 13(1); 1998; 77-93

Texture relationships were studied using both sensory and instrumental texture profile analysis (TPA) techniques to evaluate twenty-one food samples from a wide var. of foods. High linear correlations were found between sensory and instrumental TPA parameters for hardness ( $r = 0.76$ ) and springiness ( $r = 0.83$ ). No significant correlations were found between sensory and instrumental TPA parameters for cohesiveness and chewiness. Logarithmic transformations of data improved correlations between sensory attributes and their instrumental corollaries. The correlation between sensory hardness and the logarithm of instrumental hardness was improved to  $r = 0.96$ . The correlation between the logarithm of both sensory and instrumental springiness was improved to  $r = 0.86$ . The correlation between the logarithms of both sensory and instrumental chewiness was improved to  $r = 0.54$ , which was significant at  $P < 0.05$ . AA

375

Peters (AM) and Van Amerongen (A). **Relationship between levels of sesquiterpene lactones in chicory and sensory evaluation.** *Journal of the American Society for Horticultural Science* 123(2); 1998; 326-329

The levels of 2 bitter sesquiterpene lactones-lactucopicrin and lactucin like sesquiterpene lactonesw (LLSL)-were measured by ELISA in raw and cooked chicory samples from several cvs. Data were compared with the results of sensory evaluation on the flavour attributes bitterness, typical chicory flavour and total flavour intensity of identical chicory samples. Linear regression analysis showed that the levels of LLSL were significantly related to bitterness ( $P = 0.006$ ) and total flavour intensity ( $P = 0.03$ ) attributes in raw chicory samples. The LLSL levels in cooked chicory samples were significantly related to bitterness ( $P = 0.002$ ), typical chicory flavour ( $P < 0.001$ ), and total flavour intensity ( $P = 0.009$ ) attributes, while lactucopicrin levels were related to bitterness ( $P = 0.002$ ) only. Results showed that the ELISA can be useful to predict flavour attributes in chicory. SRA

376

Kallithraka (S), Bakker (J) and Clifford (MN). **Evidence that salivary proteins are involved in astringency.** *Journal of Sensory Studies* 13(1); 1998; 29-43

377

Cornillon (P), McCarthy (MJ) and Reid (DS). **Study of restricted diffusion by NMR in freeze-dried starch gels.** *Journal of Texture Studies* 28(4); 1997; 421-434

Pulsed-gradient spin-echo NMR diffraction patterns were used to determine the pore size in freeze-dried corn starch gels (7 and 12% w/w) with octane used as the probe molecule. The pore diam. are approx. 200  $\mu m$  and appear isotropic for this measurement. This technique can provide an effective measure of the pore size without altering the sample structure. AA

378

Franco (JM), Gallegos (C) and Barnes (HA). **On slip effects in steady-state flow measurements of oil-in-water food emulsions.** *Journal of Food Engineering* 36(1); 1998; 89-102

The problem of the wall slip in steady-state flow measurements of oil-in-water (ow) food emulsions has been investigated for different sensor system geometries and surface profiles. Experimental results demonstrated that slip effects are strongly dependent on the type of emulsion studied. This may be related to the emulsion microstructure. Thus, for



instance, a highly structured gel-like continuous phase dampens wall slip effects, as opposed to emulsions in which creaming appears as a mechanism of instability, because of the formation of particulate flocs. The occurrence of wall slip is more clearly observed if the flow curves are obtained from stress sweep experiments. Although the recovery of the steady-state viscosity of a presheared sample is generally complete (similar values at low and high shear rates), the appearance of slip effects may be favoured by emulsion preshearing. AA

## FOOD STORAGE

379

Bullington (SW). **Protecting stored cocoa beans from warehouse insects: An alternative system.** *Manufacturing Confectioner* 78(9); 1998; 153-160

Two of the broad-spectrum insecticides that are being phased out and that have important uses in cocoa industries such as methyl bromide and dichlorovos or DDVP is discussed in this article. CSA

## INFESTATION CONTROL AND PESTICIDES

380

Arthur (FH). **Residual toxicity of cyfluthrin wettable powder against *Tribolium confusum* (Coleoptera:Tenebrionidae) exposed for short time intervals on concrete.** *Journal of Stored Products Research* 34(1); 1998; 19-25

Adults of *Tribolium confusum* du val, the confused flour beetle, were exposed to concrete treated with 100, 150 and 200 mg cyfluthrin 20% WP (20, 30 and 40 mg [ai]/m<sup>2</sup> for 0.5, 1.0, 2.0 and 4.0 h at tri-weekly intervals for 24 wk. after the concrete was treated. Exposure temp. was approx. 22°C and RH was 60%. All beetles exposed for 1.0, 2.0 and 4.0 h on concrete treated at 200 mg/m<sup>2</sup> were inactive at 168 h post-exposure. Of the 48 treatment combinations (4 exposure times, 4 post-exposure observations, 3 application rates), only 7 were significant ( $P < 0.05$ ) with respect to weeks post-treatment. SRA

381

Platt (RR), Cuperus (GW), Payton (ME), Bonjour (EL) and Pinkston (KN). **Integrated pest management perceptions and practices and insect populations in grocery stores in South-Central United States.** *Journal of Stored Products Research* 34(1); 1998; 1-10

382

Huang (Y) and Ho (SH). **Toxicity and antifeedant activities of cinnamaldehyde against the grain storage insects, *Tribolium castaneum* (Herbst) and *Sitophilus zeamais* Motsch.** *Journal of Stored Products Research* 34(1); 1998; 11-17

The contact, fumigant and antifeedant effects (AFE) of cinnamaldehyde (CA) were tested against *Tribolium castaneum* adults and larvae and *sitophilus zeamais* adults. Both insects showed similar susceptibility to the contact toxicity of CA, both having an LC<sub>50</sub> of 0.7 mg cm<sup>-2</sup> and LC<sub>95</sub> of 0.9 mg cm<sup>-2</sup>. However, CA had a higher level of fumigant toxicity (FT) to *T. castaneum* than to *s.zeamais*, with LC<sub>50</sub> values of 0.28 and 0.54 mg cm<sup>-2</sup>, resp., and LC<sub>95</sub> values of 0.32 and 1.78 mg cm<sup>-2</sup>, resp. *T.castaneum* adults were more susceptible than larvae to the contact and FT of CA. The larvae became less susceptible to both contact and FT of CA with age. The flour disc bioassay using no-choice tests to study the AFE of CA showed that CA had no significant ( $P > 0.05$ ) effects on diet consumption and growth of *T. castaneum* adults and had no AFE against them at concn. of up to 13.6 mg g<sup>-1</sup> food. However, this compound significantly ( $P < 0.05$ ) food consumption (FC), growth and dietary utilisation of *T. castaneum* larvae, and had obvious AFE against the larvae at concn. of 27.2 and 54.4 mg g<sup>-1</sup> food. For *S. zeamais* adults, it only significantly ( $P < 0.05$ ) reduced FC at a concn. range of 6.8-13.6 mg g<sup>-1</sup> food, but had no significant ( $P > 0.05$ ) effects on the insects growth and food utilisation. These studies suggest that CA may be a potential grain protectant. SRA

383

Mullen (MA), Wileyto (EP) and Arthur (FH). **Influence of trap design and location on the capture of *Plodia interpunctella* (Indian meal moth) (Lepidoptera:Pyralidae) in a release-recapture study.** *Journal of Stored Products Research* 34(1); 1998; 33-36



Five commercial pheromone trap designs were tested simultaneously in a warehouse to determine the most effective design for capturing *Plodia interpunctella* (Hubner) (the Indian meal moth). About 72% of the males released were recaptured. The most effective trap was the wing trap (Pherocon 1c), which significantly exceeded the expected value. The remaining trap designs in order of effectiveness were the diamond trap (Pherocon II), Multipher, Delta and Unitrap. Of these four traps, only the diamond trap equalled or slightly surpassed the expected catch number. The location of the traps affected the catch, with traps located near the walls of the warehouse capturing the most insects. Unbaited traps caught few insects, and the necessity of using unbaited traps in tests is discussed. AA

384

Meikle (WG), Adda (C), Azoma (K), Borgemeister (C), Degbey (P), Djomamou (B), Markham (RH). **The effects of maize variety on the density of *Prostephanus truncatus* (Coleoptera: Bostrichidae) and *Sitophilus zeamais* (Coleoptera:Curculionidae) in post-harvest stores in Benin Republic.** *Journal of Stored Products Research* 34(1); 1998; 45-58

Maize varietal characteristics were evaluated in the field and in the laboratory for their efficacy in providing resistance to storage pests, in particular *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae) the larger grain borer, and *Sitophilus zeamais* (Motsch.) (Coleoptera: Curculionidae) the maize weevil. Resistance appeared to be associated more with the husk cover than with the grain. Higher-yielding var., even with "hard" flinty kernels, tended to suffer high *P. truncatus* damage, possibly due to the quality of the husk cover. Varietal susceptibility to *S. zeamais* did not appear to be associated with husk cover. Most damage by storage pests occurred later in the season, and damage was most strongly associated with *P. truncatus* density. An ideal maize breeding programme should include the development of maize var. able to resist insect attack for a long storage season, in addition to var. with a high yield. AA

385

Mignon (J), Haubruge (E) and Gaspar (CH). **Effect of ice-nucleating bacteria (*Pseudomonas syringae* Van Hall) on insect susceptibility to sub-zero temperatures.** *Journal of Stored Products Research* 34(1); 1998; 81-86

This study was conducted to examine the influence of the concn. of the ice-nucleating-active bacterium *Pseudomonas syringae* (10, 100 and 1000 ppm), temp. and duration of sub-zero exposure on the cold tolerance of the granary weevil *Sitophilus granarius* (L.) and the saw-toothed grain beetle *Oryzaephilus surinamensis* (L.). After an application of 1000 ppm of powdered *P. syringae* to grain, the mortality of *S. granarius* or *O. surinamensis* was increased after 24 h exposure to -4°C. Higher mortality was observed after exposure to colder temp. and a dose response relationship was evident. At near-zero (-4 to 0°C) negative temp., no dose response was observed, and mortality in treated grain was the same as that in untreated grain. SRA

386

Athie (I), Gomes (RAR), Bolonhezi (S), Valentini (SRT) and De Castro (MFPM). **Effects of carbon dioxide and phosphine mixtures on resistant populations of stored-grain insects.** *Journal of Stored Products Research* 34(1); 1998; 27-32

This study indicated that the mixtures of phosphine (PH<sub>3</sub>) plus 10 and 20% CO<sub>2</sub> reduced the resistance levels (RL) of the *Sitophilus oryzae* populations. The more susceptible portion of the *Rhyzopertha dominica* populations showed a decrease in the required PH<sub>3</sub> concn. with an increase in CO<sub>2</sub>, but PH<sub>3</sub> alone seemed to be more effective than the mixtures with CO<sub>2</sub> for the control of the more resistant portion. The mixtures of PH<sub>3</sub> + CO<sub>2</sub> reduced the RL to PH<sub>3</sub> in populations of *R. dominica* and *S. oryzae*, although a clear pattern could not be determined. Resistant populations of *R. dominica* and *S. oryzae* to PH<sub>3</sub> showed different mortality responses to treatments with mixtures of PH<sub>3</sub> + 10 and 20% CO<sub>2</sub>. SRA

387

Dowdy (AK) and Mullen (MA). **Multiple stored-product insect pheromone use in pitfall traps.** *Journal of Stored Products Research* 34(1); 1998; 75-80

The effect of the paired interaction of synthetic pheromones used in the same trap on the effectiveness of trapping *Rhyzopertha dominica*, *Tribolium castaneum* and *Trogoderma variable* was examined. There was no significant interactions (P > 0.05) for the number of each sp. collected in the traps for the 3 pheromone pairs tested at either 24 or 48 h post-release the data were analyzed in a 2 x



2 factorial design. The use of pheromones for 2 sp. in one trap did not influence the effectiveness of the trap. Although there was inhibition caused by *T. castaneum* pheromone on *T. variable* when presented alone. This should not impact adversely on the ability of the 2 pheromones to be used effectively in the same trap in a monitoring program. Using a single trap to monitor 2 insects sp. will result in reduced cost, purchase of less traps and reduced labour. SRA

388

Morgan (C), Sherington (J), Gudrups (I) and Bowden (NS). **The assessment of potential attractants to beetle pests: Improvements to laboratory pitfall bioassay methods.** *Journal of Stored Products Research* 34(1); 1998; 59-74

In this study, 8 sp. of stores product insects (*Ahasverus advena*, *Oryzaephilus surinamensis*, *Rhyzopertha dominica*, *Prostephanus truncatus*, *Sitophilus granarius*, *S. oryzae*, *S. zeamais* and *Stegobium paniceum*) were tested against known attractants to investigate certain aspects of the bioassay procedure likely to influence the sensitivity of the test. The factors investigated were the test duration, pitfall lip size (PFLS) and arena size (AS). For the majority of the sp. tested, either the differentiation between control and attractant results was good, irrespective of the bioassay design. Although 100 mm AS generally trapped larger numbers of insects, the differentiation between treatment and control samples (CS) was optimal with differing AS for different insect sp. PFLS appeared to be the least import factor in increasing the differentiation between the treatment and CS. SRA

## BIOCHEMISTRY AND NUTRITION

389

Ranhotra (GS), Gelroth (JA), Leinen (SD) and Ricklefs (TW). **Effect of shortenings containing stearic acid on blood lipids and fat digestibilities in hamsters.** *Cereal Chemistry* 75(4); 1998; 557-559

Tristearin (TS), a stearic acid-rich hard fat, and soybean oil (SO) were blended in different ratios to produce four functional shortenings (blends) for use in foods. Groups of hamsters were then fed diets containing TS, SO, and the 4 blends for 4 wks. After 4 wks., serum total cholesterol (CH) levels were

measured: the group fed SO had 219 plus or minus 19 mg/dL, and the groups fed 4 blends had a range of 214 plus or minus 14 to 222 plus or minus 15 mg/dL. Thus, TS in the blends exerted no hypercholesterolemic effect; it even lowered serum triglycerides (SO vs. blends). Liver CH levels were significantly lower only in the group fed the blend containing the highest level (60%) of TS. While SO was nearly completely digested (97.7%), digestibility of TS in the blends was low with a range of 10.2-26.3 %, which was inversely related to the level of TS in the blend. Thus, functional shortenings produced by blending TS with edible oils may not only not raise blood CH levels, but they would be free of *trans* fatty acids and may be classified as reduced-calorie fats. AA

390

Kuwamori (M), Wada (M), Takita (T), Tadokoro (T), Maekawa (A), Innami (S). **Effects of dietary n-3/n-6 fatty acid ratio on the total count, fatty acid composition and histamine and leukotriene concentrations of mast cells in *Tunica mucosa bronchiorum* of type I allergic Guinea. pig.** *Bioscience, Biotechnology and Biochemistry* 61(5); 1997; 763-767

391

Nonaka (M), Yamashita (K), Iizuka (Y), Namiki (M) and Sugano (M). **Effects of dietary sesaminol and sesamin on eicosanoid production and immunoglobulin level in rats given ethanol.** *Bioscience, Biotechnology and Biochemistry* 61(5); 1997; 836-839

The effects of sesaminol and sesamin on the ethanol-induced modulation of immune indices related to food allergy were examined in rats given a low (10%)-casein diet. Chronic ethanol drinking, at the dietary level of 23% (w/w), significantly increased the plasma IgA and IgM concn., irrespective of the presence of 0.1% and 0.2% sesaminol, but effects disappeared with 0.2% sesamin. A significant IgG-elevating effect of these lignans was also found. In contrast, the concn. of plasma IgE was not influenced by the dietary manipulation. Although ethanol drinking did not influence splenic leukotriene B production, sesaminol tended to decrease it dose dependently, while sesamin increased the plasma prostaglandin E<sub>2</sub> concn. These results suggest that sesaminol and sesamin seems to have a diverse effect on the plasma levels of immunoglobulins and eicosanoids. AA



## TOXICOLOGY

392

Hefle (SL). **Food allergens.** *Manufacturing Confectioner* 78(5); 1998; 85-92

Allergens cross-contact can occur in food-processing and manufacturing environments and can be hazardous to a small number of

individuals in the population. A review of common processing and labeling practices and instituting scheduling and validation of cleaning procedures with regard to allergenic residues can help to control allergenic cross-contact. CSA

## FOOD LAWS AND REGULATIONS

Nil







- Abbott (JA)  
298
- Abe (J-i)  
247
- Adda (C)  
384
- Adhikaritanayake (TB)  
252
- Adlercreutz (P)  
218
- Agarwal (YC)  
362
- Ahmad (R)  
255
- Aitzetmuller (K)  
273
- Akoh (CC)  
359
- Akterian (SG)  
342
- Almeida-Dominguez (HD)  
270
- Alzamora (SM)  
293
- Amarowicz (R)  
279
- Ames (JM)  
217 219
- Ammu (K)  
348
- Angyal (G)  
246
- Antony (JIX)  
297
- Anzaldúa-Morales (A)  
291
- Arasaratnam (V)  
271
- Arslan (N)  
288
- Arthur (FH)  
380 383
- Atapattu (C)  
302
- Athie (I)  
386
- Attia (AA)  
341
- Attia (EL-SA)  
341
- Azcona (JI)  
222
- Azoma (K)  
384
- Bae (SO)  
267
- Baik (B-K)  
274
- Bailey (RG)  
219
- Bakker (J)  
376
- Balasubramaniam (K)  
271
- Banat (IM)  
243
- Barcina (Y)  
332
- Barnes (HA)  
378
- Barrera-Arellano (D)  
354
- Bech (AC)  
277
- Belessiotis (VG)  
290
- Bello-Perez (LA)  
314
- Ben-Amotz (A)  
283
- Benitez (T)  
240
- Berger (RG)  
242
- Berry (SK)  
207 369
- Bhaduri (S)  
236
- Bhatty (RS)  
248
- Bina Desai  
227
- Blanshard (JMV)  
216
- Block (JM)  
354
- Boatright (WL)  
282
- Boekel (MAJSV)  
326
- Bohonko (M)  
250
- Bolonhezi (S)  
386
- Bonjour (EL)  
381
- Borgemeister (C)  
384
- Boria (P)  
345
- Bowden (NS)  
388
- Breivik (H)  
349 357
- Briggs (JL)  
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- Brown (SK)  
295
- Brule (G)  
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- Brusewitz (GH)  
291
- Bryden (WL)  
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- Bullington (SW)  
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- Busse (M)  
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- Campanella (OH)  
213
- Campos (NC)  
346
- Cao (T)  
263
- Carpenter (JA)  
374
- Casaus (P)  
230
- Castro (MA)  
293
- Cavella (S)  
325
- Chang (R-C)  
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- Changying (J)  
311
- Chapron (L)  
328
- CharoENCHAI (P)  
232
- Chattopadhyay (PK)  
210
- Chau (HK)  
269
- Chauhan (AS)  
221
- Cheah (SC)  
366
- Chen (H)  
253
- Chen (P)  
260
- Chen (Y)  
225
- Chen (ZY)  
355
- Cheng (H-M)  
310
- Chia (LG)  
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Cintas (LM)  
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Clark (DC)  
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Cleemput (G)  
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Clementi (F)  
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Clifford (MN)  
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Colonna (P)  
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Condon (S)  
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Cornillon (P)  
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Cottrell (B)  
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Coupland (JN)  
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Craig (JC)  
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Crum (AD)  
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Cuperus (GW)  
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Cuq (B)  
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Dague (RR)  
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Damme (LV)  
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De Castro (MFPM)  
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De Haro (A)  
365  
De Morais (C)  
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Degbey (P)  
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Delcour (JA)  
320  
Delwiche (SR)  
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Deosthale (YG)  
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Derbyshire (W)  
216  
Devadasan (K)  
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Devineni (N)  
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Di Gioia (L)  
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Dickey (LC)  
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Dixon (J)  
292  
Djomamou (B)  
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Djordjevic (GM)  
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Doane-Weideman (T)  
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Doehlert (DC)  
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Doner (LW)  
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Dowdy (AK)  
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Draisci (R)  
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Dunn (NW)  
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Durier (C)  
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Dybowska (BE)  
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Dyer (W)  
307  
Eipeson (WE)  
221  
Eliasson (A-C)  
265  
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Enomoto (K)  
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Entis (P)  
231  
Eppert (I)  
331  
Fach (P)  
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Famelart (M-H)  
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Fehr (WR)  
280  
Feillet (P)  
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Fernandez-Martinez (JM)  
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Fernandez-Muino (MA)  
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Figueiredo (MF)  
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Fishler (R)  
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Fishman (ML)  
269  
FitzGibbon (F)  
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Foglia (TA)  
300  
Franco (JM)  
378  
From (M)  
218  
Fu (BX)  
264 318  
Fujio (Y)  
281  
Fustier (P)  
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Gallegos (C)  
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Gangar (V)  
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Garcia (MM)  
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Garde (S)  
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Gasent-Ramirez (JM)  
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Gaspar (CH)  
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Gaya (P)  
334 335  
Gelinas (P)  
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Gelroth (JA)  
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Georgieva (VG)  
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Ghorai (K)  
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Giannetti (L)  
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Jalani (BS)  
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Kristensen (K)  
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Kristensen (M)  
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Kristinsson (B)  
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Kumagai (H)  
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Kumar (V)  
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Kurantz (M)  
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 Mato (I)  
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 Miller (KA)  
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 Miltz (J)  
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 Mirade (PS)  
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 Montville (TJ)  
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 Moore (WR)  
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 Moresi (M)  
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 Nagender (A)  
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 Nair (PGV)  
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 Nakamura (K)  
 237 239  
 Namiki (M)  
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 Narasimhamurthy (K)  
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 Navarro (AS)  
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 Ndon (UJ)  
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 Nelles (EM)  
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 Ning (S)  
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 Nonaka (M)  
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Otto (T)  
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Panesar (PS)  
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Pangas (TK)  
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Paredes-Lopez (O)  
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Parris (N)  
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Pierard (D)  
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Piot (M)  
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Planchot (V)  
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Platt (RR)  
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Popoff (MR)  
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Prajapati (JB)  
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Prasad (MM)  
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Pratima Shastri  
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Proctor (A)  
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Qvist (KB)  
330 333  
Rader (JI)  
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Radewonuk (ER)  
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Raina (PL)  
360  
Ram Gopal  
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Ramteke (RS)  
221  
Randall (PG)  
317  
Ranhotra (GS)  
389  
Ranieri (TL)  
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Rao (M)  
301  
Rao (MV)  
295  
Recseg (K)  
367  
Reddy (MM)  
301  
Reid (DS)  
377  
Renner-Nantz (JJ)  
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Reshma (SV)  
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Ricklefs (TW)  
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Rigney (MP)  
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Robertson (GH)  
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Rodriguez (JM)  
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Roger (P)  
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Rogers (DE)  
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Sahlstrom (S)  
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Saito (H)  
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Salovaara (H)  
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Salvatori (D)  
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Sanchez (MP)  
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Sancho (MT)  
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Shankar (D)  
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Sherington (J)	Tadokoro (T)	Visser (FR)
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Shimada (Y)	Takahashi (K)	Wada (M)
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362	329	295
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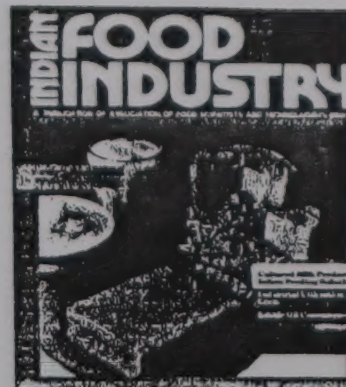
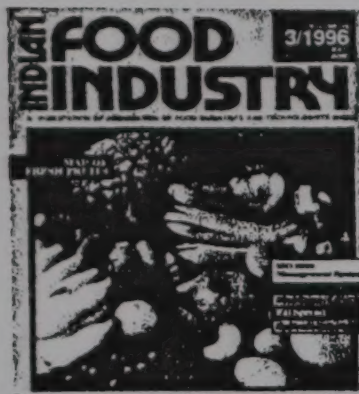


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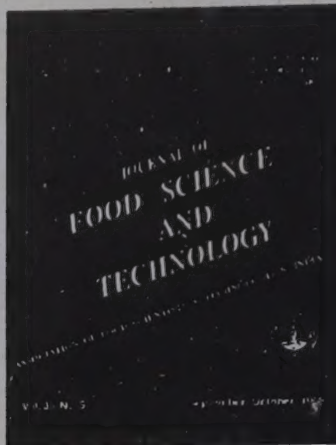


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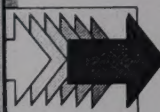


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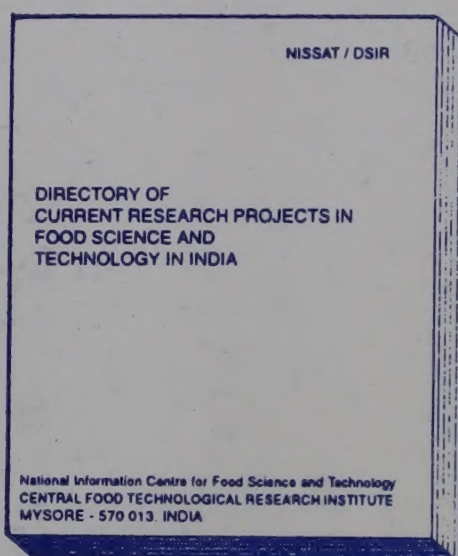
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